# Addendum to Environmental Management Plan for 215 Cooper Street, New Epping, Victoria

**Date:** 25 June 2024

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**Ref:** 14592

## 1 Introduction

Ecology and Heritage Partners Pty Ltd was commissioned by Riverlee Caruso Epping Pty Ltd to provide a summary of updates to the existing Environmental Management Plan (EMP) prepared by Ecology Australia for the proposed development at 215, 315W and 325C Cooper Street, New Epping.

Updates to the EMP are presented in this addendum in the below tables.

## 2 Background

The property at 215 Cooper Street, New Epping is approximately 45.5 ha where the majority of the land was historically used to quarry basalt. This activity has left large pits. The majority were backfilled following completion of quarrying, however some remained open resulting in a collection of permanent and ephemeral waterbodies.

This site now supports a regionally significant population of Growling Grass Frog *Litoria raniformis major* and that have been detected throughout the property. Growling Grass Frog is listed as vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Flora and Fauna Guarantee Act 1988* (FFG Act). An extant population of Golden Sun Moth also occurs on the property at 315W and 325C Cooper Street, New Epping. Golden Sun Moth area listed as vulnerable under the EPBC Act and FFG Act. Offsets for Golden Sun Moth will be secured in the Western Grassland Reserve and are covered in less detail in the management plan.

## 3 Updates to the Management Plan

The EMP was prepared for the study area to address the impacts of the development on site. The management plan was prepared in 2018-19 by Ecology Australia Pty Ltd however, due to changes across the site including construction timing and the extent of the habitat corridor, updates to this document are required and is the subject of this addendum.

This EMP has been updated in accordance with Condition 22 and 23 of the EPBC Approval (EPBC 2016/7755) as we have assessed that the changes do not result in a new or increased impact. The changes made to the EMP are predominately administrative and relate to updates to project timing (i.e. program updates) and changes as a results of minor adjustment to the habitat corridor boundary in accordance with the approved Development Plan boundaries. A summary of the changes made to the EMP are provided in Section 4 below.

The following addendum schedule sets out our proposed amendments to the 'current' EMP (Ecology Australia dated 22/10/2019 as submitted on the 9/9/2019 & 16/05/2023). The schedule lists references points and nominated text that is proposed to be amended within the 'current' EMP, and states the alternative text under 'Updated text'. This addendum should be read in conjunction with EMP dated 22/10/2019 (Appendix 1).

# 4 Addendum to Environmental Management Plan

| Update # | Section | Page | Paragraph | Current text | Updated text |
|---|---|---|---|---|---|
| 1 | Entire report | - | - | Department of Environment, Land, Water and Planning (DELWP) | Department of Department of Energy, Environment and Climate Action (DEECA) |
| 2 | Entire report | - | - | Department of the Environment and Energy (DoEE) | Department of Climate Change, Energy, the Environment and Water (DCCEEW) |
| 3 | Summary | 8 | 6 | Riverlee proposes to construct an 11.44 ha Growling Grass Frog habitat corridor along Edgars Creek, which will be remediated and revegetated. | Riverlee proposes to construct an **12.82 ha** Growling Grass Frog habitat corridor along Edgars Creek, which will be remediated and revegetated. |
| 4 | Summary | 9 | Point 2 | Riparian habitat (4.31 ha within 30 m of wetlands) and terrestrial habitat (3.8 ha) designed and managed specifically for Growling Grass Frogs. | Riparian habitat (4.31 ha within 30 m of wetlands) and terrestrial habitat (**5.52 ha**) designed and managed specifically for Growling Grass Frogs. |
| 5 | Summary | 9 | Point iii | A two year Growling Grass Frog migration phase and, if required, an additional adaptive management phase. | A minimum 18 month Growling Grass Frog migration phase to capture two breeding seasons and, if required, an additional adaptive management phase. |
| 6 | Summary | 9 | Point v | Post construction habitat management, to be outlined in a separate offset management plan. | Post 'habitat corridor' management to be outlined in the Onsite Offset Management Plan (OMP). |
| 7 | Summary | 9 | Point 6. Item 6. | Wetland water quality management, including maintaining lower salinity (<3,000 µS/cm) and higher salinity (<7,000 µS/cm) wetlands. | Wetland water quality management, including maintaining salinity in accordance with DEECA Growling Grass Frog habitat design standards (moderate salinity up to 5,000 µS/cm. |
| 8 | Summary | 10 | 3 | This EMP will remain in force until the habitat corridor is successfully established, the migration and adaptive management phase are complete and existing Growling Grass Frog habitat outside the habitat corridor is removed, when it will be replaced by an onsite Offset Management Plan (OMP). | This EMP will come into effect upon commencement of the action and remain in force until completion of construction of the Edgars Creek habitat corridor. Once construction of the habitat corridor is complete, this EMP will be replaced by an Onsite OMP which will cover the migration and adaptive management phases of the project.<br>The management of the Offsite Offset Site commenced on 29/06/2023. |

| Update # | Section | Page | Paragraph | Current text | Updated text |
|---|---|---|---|---|---|
| 9 | Figure 1 | 12 | - | - | **Update:** Figure 1 updated. |
| 10 | Section 2 | 13 | Table 1. Condition 3 | To compensate for the loss of 17.39 ha of Growling Grass frog habitat, the approval holder must implement the Growling Grass Frog Offset Strategy, and ensure that a viable population of the Growling Grass Frogs is maintained at the proposed offset areas for 10 years. | To compensate for the loss of **15.67 ha** of Growling Grass frog habitat, the approval holder must implement the Growling Grass Frog Offset Strategy, and ensure that a viable population of the Growling Grass Frogs is maintained at the proposed offset areas for 10 years. |
| 11 | Section 2 | 13 | Table 1. Condition 4c | By 2019 | Late 2024 |
| 12 | Figure 2 | 20 | - | - | **Update:** Figure 2 updated. |
| 13 | Section 4.2.1 | 25 | 1 | The New Epping development aims to deliver a 300-bed private hospital, 200 aged care beds, 200 retirement living units, 2,000 new private residences, 80,000 m2 for commercial activities and 11.44 hectares of natural environment. | The New Epping development aims to deliver a 300-bed private hospital, 200 aged care beds, 200 retirement living units, 2,000 new private residences, 80,000 m2 for commercial activities and **12.82 hectares** of natural environment. |
| 14 | Section 4.2.2 | 25 | 1 | Green Quarter | Living Quarter – updated throughout report |
| 15 | Section 4.2.3 | 25 | 1 | Prior to development of the Green Quarter, an 11-ha habitat corridor will be established to create and improve habitat for the site's Growling Grass Frog population. | Prior to development of the **Living** Quarter, **a 12.82 ha** habitat corridor will be established to create and improve habitat for the site's Growling Grass Frog population. |
| 16 | Figure 5 | 26 | - | - | **Update:** Figure 5 updated. |
| 17 | Section 4.2.3 | 27 | 5 | It is anticipated that the rezoning will occur by late 2019/early 2020. | **Update:** Rezoning of the land has occurred however, further changes may be required and may occur by late 2024. |
| 18 | Section 4.2.4 | 27 | | 1. Pre-construction phase – establishment of the habitat corridor;<br>2. Construction phase – proposed development precincts (see Figure 5), being:<br>- Area 1 – Northern part of the Urban Quarter and Health Quarter; then<br>- Area 2 Green Quarter; then | 1. Pre-construction phase (EMP) – construction of the habitat corridor;<br>2. Construction phase (OMP) – proposed development precincts (see Figure 5), being:<br>- Area 1 – Northern part of the Urban Quarter and Health Quarter; then<br>- Area 2 **Living** Quarter; then |

| Update # | Section | Page | Paragraph | Current text | Updated text |
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| | | | | - Area 3 – southern part of the Urban Quarter and Health Quarter.<br>3. Post-construction phase – maintenance and monitoring. | - Area 3 – southern part of the Urban Quarter and Health Quarter.<br>3. Post-construction phase (OMP) – maintenance and monitoring of habitat corridor. |
| 19 | Section 4.2.4 | 28 | 2 | Development of the Growling Grass Frog habitat corridor will occur during the pre-construction phase; during this period, and for two breeding seasons following (i.e. October 2020 to April 2022), no construction will occur in precincts that currently support Growling Grass Frog habitat (Green Quarter; Figure 5). | Development of the Growling Grass Frog habitat corridor will occur during the pre-construction phase; during this period, and for two breeding seasons following (i.e. **June 2026 until January 2028**), no construction will occur in precincts that currently support Growling Grass Frog habitat (**Living** Quarter; Figure 5) **with the exception of areas indicated in Figure 9**. |
| 20 | Section 4.2.4 | 28 | 4 | Should all approvals be resolved within this time, development of the health quarter (adjacent to the cooper street frontage) is planned to commence in early-2020. | Should all approvals be resolved within this time, development of the health quarter (adjacent to the cooper street frontage) is planned to commence in **early-2022.** |
| 21 | Section 4.2.4 | 29 | Table 2 | - | Refer to Updated Table 2 below. |
| 22 | Figure 6 | 31 | - | - | **Update:** Figure 6 updated |
| 23 | Section 4.2.4 | 32 | 5 | The abutments for the bridge over Edgars Creek will also be laid during the pre-construction phase. This will enable the bridge to be built during the construction phase with minimal disturbance to the habitat corridor, after its establishment (Section 7.4.14). | The abutments for the bridge over Edgars Creek may also be laid during the pre-construction phase, **subject to availability of Council approvals for the structure. As a minimum construction access for the purposes of constructing the bridge will be laid.** This will enable the bridge to be built during the construction phase with minimal disturbance to the habitat corridor, after its establishment (Section 7.4.14). |
| 24 | Section 4.2.5 | 32 | Point 1 | A migration period lasting two full breeding seasons after the practical completion of Growling Grass Frog wetlands corresponding to the commencement of the prescribed maintenance period (i.e. not prior to mid-2022; Table 2). | A migration period lasting two full breeding seasons (i.e minimum of 18 moths commencing in November) after completion of the habitat corridor construction. |
| 25 | Figure 7 | 33 | - | - | **Update:** Figure 7 updated |

| Update # | Section | Page | Paragraph | Current text | Updated text |
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| 26 | Section 4.2.5 | 35 | 4 | Areas for material stockpiling, vehicle access and parking during construction will be confined to selected areas outside of the Growling Grass Frog habitat corridor and the no-go zones in the Green Quarter. | Areas for material stockpiling, vehicle access and parking during construction will be confined to selected areas outside of the Growling Grass Frog habitat. |
| 27 | Section 4.2.5 | 35 | 5 | During the construction phase, the grassy stormwater drain in the north east of the site will be piped and enter Edgars Creek at the northern in-stream wetland (wetland 12). | During the **pre-construction phase**, the grassy stormwater drain in the north east of the site will be piped and enter Edgars Creek at the northern in-stream wetland (wetland 12). |
| 28 | Section 4.2.6 | 35 | 1 | Following the removal of existing Growling Grass Frog habitat outside the habitat corridor, there will be ongoing maintenance and monitoring. | Following the removal of existing Growling Grass Frog habitat outside the habitat corridor, there will be ongoing maintenance and monitoring **that initially commenced upon completion of the habitat corridor works as is required for a period of 10 years.** |
| 29 | Section 4.2.6 | 36 | 5 | There will be two surveys of Growling Grass Frogs per breeding season (generally October to March), and will align with the EPBC act survey guidelines (DEHWA 2009a). | There will be two surveys of Growling Grass Frogs per breeding season **conducted by a suitably qualified ecologist** (generally October to March), and will align with the EPBC act survey guidelines (DEHWA 2009a). |
| 30 | Section 5.1.1 | 38 | Table 3 | - | Refer to Updated Table 3 below. |
| 31 | Section 5.1.1 - Terrestrial Habitat | 40 | 1 | The proposed development includes the removal of 9.13 ha of terrestrial habitat, allowing for metapopulation movement between existing waterbodies. | The proposed development includes the removal of **7.41 ha** of terrestrial habitat, allowing for metapopulation movement between existing waterbodies. |
| 32 | Section 5.1.1 - Terrestrial Habitat | 40 | 5 | Approximately 5.18 ha of terrestrial habitat are proposed to be constructed within the habitat corridor… | Approximately **5.52 ha** of terrestrial habitat are proposed to be constructed within the habitat corridor… |
| 33 | Section 5.1.1 - Terrestrial Habitat | 40 | 5 | Hence, there is effectively a loss of approximately 3.95 ha of terrestrial habitat (Table 3). | Hence there is effectively a loss of approximately **3.61 ha** of terrestrial habitat (Table 3). |
| 34 | Section 5.1.3 | 46 | 3 | - | Refer to updated Figure 9 for haul roads and stockpile locations. |

| Update # | Section | Page | Paragraph | Current text | Updated text |
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| 35 | Section 5.1.5 | 49 | Point 3 | Approximately 39.7 ha of terrestrial habitat, although the 30.6 ha of this would likely be rarely utilised by Growling Grass Frogs. | Approximately **37.98 ha** of terrestrial habitat, although the 30.6 ha of this would likely be rarely utilised by Growling Grass Frogs. |
| 36 | Section 6 | 52 | Point 8 | - | **Ecology and Heritage Partners (EHP)** – Will be involved with the implementation of this plan including on ground monitoring and other operations during construction and post-construction. |
| 37 | Section 7.4.1 | 54 | 1 | Point (i) - Late 2019<br>Point (v) - Late 2019<br>Point (vi) - Mid 2020<br>Point (vii) - October 2020 until April 2022<br>Point (viii) - Early 2021 until April 2023 | Point (i) – **June 2024**<br>Point (ii) – **June 2024 – June 2026**<br>Point (iii) – **March 2026 – June 2026**<br>Point (iv) – **June 2026 until January 2028**<br>Point (v) – **February 2028 until January 2029** |
| 38 | Section 7.4.1 | 55 | (vii) | 'Frog migration' period of 20 months covering 2 breeding seasons to allow the frogs to colonise constructed wetlands and establish breeding populations. | 'Frog migration' period of a minimum of **18 months** covering 2 breeding seasons to allow the frogs to colonise constructed wetlands and establish breeding populations. **The migration period is covered in the Onsite OMP.** |
| 39 | Section 7.4.1 | 55 | 2 | April 2022 until mid-2024. | **November 2026 until mid-2028**. This portion is covered in the Onsite OMP. |
| 40 | Section 7.4.1 | 55 | 2 | Following this phase, this EMP will be superseded by the OMP. | **Updated text:** Following completion of construction of the Edgars Creek habitat corridor this EMP will be replaced by the onsite Offset Management Plan which will cover the migration and adaptive management phases of the project. |
| 41 | Section 7.4.1 | 55 | 3 | Mid 2024 to late 2029 | **November 2026 until November 2036.**<br>'Post-construction' is defined as post-construction of the habitat corridor, not post-construction of the no-go zones (i.e. Living Areas). |
| 42 | Figure 9 | 56 | - | - | **Update:** Figure 9 updated. |

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| | | | | | New haul roads have been included on Figure 9 to allow access to Edgars Creek for the construction of the proposed bridge crossing. An additional construction area is are also required within the existing Growling Grass Frog habitat to facilitate the construction of the bridge. The construction area aligns with an existing access track and will avoid removal of aquatic habitat for Growling Grass Frog. Additional stockpile locations are also proposed outside of Growling Grass Frog habitat. |
| 43 | Section 7.4.5 | 61 | Table 4 | Wetland sizes | Refer to Updated Table 4 below. |
| 44 | Section 7.4.5 | 61 | Table 5 | Wetland specifications | Refer to Updated Table 5 below. |
| 45 | Section 7.4.5 | 68 | Wetland Water Management | The system will use a combination of water sources (primarily quarry water and potable water, but potentially stormwater and rooftop rainwater as the project develops) to manage salinity in the constructed wetlands. | **Updated text:** The system will primarily rely on quarry water fed into a tank which can be topped up with potable water If necessary (and potentially stormwater and rooftop water post development) to manage and control the quality of water prior to it being supplied to the constructed GGF wetlands. |
| 46 | Section 7.4.5 | 68 | Wetland Water Management | Ponds will be managed at two salinity levels, as frogs from more saline waterbodies tend to have a lower chytrid load (Stockwell et al. 2015). Ponds 2, 4 and 7 will be managed as brackish wetlands (<7000 µS/cm) and ponds 1, 3, 5 and 6 as freshwater wetlands (<3,000 µS/cm) | **Updated text:** As salinity is expected to increase in ponds due to evaporation, a primary water source from the quarry hole (approximate salinity 3,300 µS/cm) will be used. Salinity will be monitored and managed in wetlands through the water delivery system. |
| 47 | Section 7.4.5 | 71 | Wetland Water Quality | A variety of salinities will be managed in the constructed wetlands on site, these will be maintained by utilising a variety of water sources for the wetlands. Specifically wetlands will be maintained at:<br>- Lower salinity (<3,000 µS/cm, wetlands P1, P3, P5 and P6) using a combination of groundwater and freshwater.<br>- Lower salinity (wetlands E1, E2, E3, <3,000 µS/cm when full). As ephemeral wetlands will increase in salinity over | **Updated text:** All wetlands will use a single water source from the quarry hole with a salinity of approximately 3,300 µS/cm. As salinity is expected to increase over time due to evaporation, the water delivery system will allow potable water to be added to reduce salinity in the storage tank the feeds the wetlands. |

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| | | | | time due to regular drying out, groundwater use will be minimal.<br>- Higher salinity (<7,000 µS/cm) using primarily groundwater (wetlands P2, P4 and P7). | |
| 48 | Section 7.4.5 | 72 | Table 6 | Maximum values for water quality parameters in Growling Grass Frog wetlands, taken from DELWP (2017b) | Refer to Updated Table 6 below. |
| 49 | Section 7.4.13 | 91 | Point 2 | When constructing and working in habitat corridor:<br>- clean vehicles coming on site at a designated wash down area and/or ensure vehicles have been washed down immediately prior to coming on site.<br>- clean and disinfect equipment to minimise the risk of introducing or spreading chytrid fungus.<br>- clean and disinfect footwear when working around growling grass frog habitats including during salvage and relocation | **Updated text:** Appropriate wash down and disinfection procedures to be determined by contractor in consultation with a suitably qualified ecologist. |
| 50 | Figure 12 | 94 | - | - | **Update:** Figure 12 updated. |
| 51 | Section 7.5 | 110-112 | Table 9 | Low salinity wetlands (wetlands 1, 3, 5, and 6) to be maintained at <3,000 µs/cm) and high salinity wetlands (wetlands 2, 4 and 7) to be maintained at <7,000 µs/cm. | **Update:** Remove reference to low and high salinity wetlands. All water sourced from quarry hole with salinity of approximately 3,300 µS/cm. |
| 52 | Section 15 | 150-151 | Glossary | - DELWP – Victoria Department of Environment, Land, Water and Planning<br>- DoEE – Commonwealth Department of Environment and Energy | - DEECA – Department of Department of Energy, Environment and Climate Action<br>- DCCEEW – Department of Climate Change, Energy, the Environment and Water |

## 4.1 Table Updates

**Updated Table 2**. Indicative timing of activities associated with the pre-construction and construction phases of the New Epping redevelopment.

| Activity | Duration (months) | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EMP Phase | | | | | | | OMP Phase | | | | |
| **Habitat Corridor (Pre-construction period, Growling Grass Frog area)** | | | | | | | | | | | |
| EPBC 'Action' Approval | Complete | | | | | | | | | | |
| Detail Design & Approvals | 15 | | | | | | | | | | |
| EMP and OMP Approvals | 15 | | | | | | | | | | |
| Tender and Award | 3 | | | | | | | | | | |
| Construction | 27 | | | | | | | | | | |
| Revegetation | 12 | | | | | | | | | | |
| Frog Migration* | 18 | | | | | | | | | | |
| Adaptive Management* | 12 | | | | | | | | | | |
| **Area 1 - Urban Quarter, Health North (Construction period, non-Growling Grass Frog area)** | | | | | | | | | | | |
| Environmental Audit | Complete | | | | | | | | | | |
| Design and Approvals | Complete | | | | | | | | | | |
| Tender and Award | Complete | | | | | | | | | | |
| Construction (Civil) | Complete | | | | | | | | | | |
| Construction (Built Form) | Ongoing | | | | | | | | | | |
| EMP Phase | | | | | | | OMP Phase | | | | |
| **Area 2 - Living Quarter (Construction period, Growling Grass Frog area)** | | | | | | | | | | | |

| Activity | Duration (months) | 2022 | | | | 2023 | | | | 2024 | | | | 2025 | | | | 2026 | | | | 2027 | | | | 2028 | | | | 2029 | | | | 2030 | | | | 2031 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Environmental Audit | Complete | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Frog Migration* | 18 | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | |
| Design and Approvals | 6 | | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | | | | | | | | | | | | | | |
| Tender and Award | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | ■ | | | | | | | | | | | | | | |
| Construction (Bulk Earthworks)** | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | | | | | | | | | |
| Construction (Civil)** | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | | | | | | | | |
| Construction (Built Form)** | 33 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| **Area 3 – Urban Quarter, Health Quarter South (Construction period, non-Growling Grass Frog area)** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Environmental Audit | Complete | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Design and Approvals | 15 | | | | | | | | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tender and Award | 6 | | | | | | | | | | | | | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction (Bulk Earthworks) | 3 | | | | | | | | | | | | | | | ■ | | | | | | | | | | | | | | | | | | | | | | | | | |
| Construction (Civil) | 6 | | | | | | | | | | | | | | | | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | |
| Construction (Built Form) | 57 | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | |

* Adaptive Management will only occur if Growling Grass Frog do not successfully colonise constructed Growling Grass Frog wetlands.

** The timing of construction in the Living Quarter will be based on the successful migration of Growling Grass Frog to the habitat corridor. If frogs have not successfully colonised Growling Grass Frog wetlands, an additional adaptive management phase will occur. See Section 4.2.5 for further information.

**Updated Table 3**. Initial areas of each habitat type, and habitat areas lost, retained and constructed and the net gain/loss of each habitat type. Areas are in hectares.

| Habitat type | Initial area | Area lost | Area retained | Area constructed | Final area | Net loss/gain |
|---|---|---|---|---|---|---|
| Off channel wetland | 3.52 | 2 | 1.52 | 1.14 | 2.66 | -0.86 |
| In stream wetlands | 0.51 | 0.02 | 0.49 | 0.18 | 0.67 | +0.16 |
| Riparian (30 m from wetlands) | 7.42 | 6.28 | 1.14 | 3.17 | 4.31 | -3.11 |
| Terrestrial – suitable for Growling Grass Frogs | 9.13 | 9.13 | 0 | 5.52 | 5.52 | -3.61 |
| Terrestrial unsuitable for Growling Grass Frogs | 30.6* | 30.6 | 0 | 0 | 0 | -30.6 |
| **Total** | **51.18** | **48.03** | **3.15** | **10.01** | **13.16** | **-38.02** |

*includes 25.18 ha of unsuitable Growling Grass Frog habitat and 5.42 ha of GSM habitat.

**Updated Table 4**. Proposed and existing wetlands to be created, retained and removed at the New Epping site and their location and hydroperiod.

| Wetland number and description | Hydroperiod | Location | Size (m²) |
|---|---|---|---|
| **Wetlands to be removed (Figure 2)** | | | |
| 2 – Quarry hole | Permanent | Off-stream | 3,500 |
| 3 – Quarry hole, shallow extension of '2' | Permanent | Off-stream | 5,720 |
| 4 – Large 'lime pond', extension of '3' | Permanent | Off-stream | 3,080 |
| 5 – Small 'lime pond' | Permanent | Off-stream | 580 |
| 6 – Small clay dam | Permanent | Off-stream | 230 |
| 7 – Large clay dam | Permanent | Off-stream | 660 |
| 8 – Shallow artificial | Ephemeral | Off-stream | 3,270 |
| 9 – Shallow ephemeral pond | Ephemeral | Off-stream | 1,030 |
| 10 – Shallow ephemeral pond | Ephemeral | Off-stream | 1,260 |
| Marsh 11 – Small pool in Edgars Creek | Ephemeral | In-stream | 180 |
| 13 – Shallow ephemeral depression | Ephemeral | Off-stream | 500 |
| **Total wetlands removed** | | | **20,010** |
| **Wetlands to be retained (Figure 2)** | | | |
| 1 – Large quarry hole | Permanent | Off-stream | 15,200 |
| 12 – Large planted pool in Edgars Creek | Permanent | In-stream | 1,360 |
| **Total wetlands retained** | | | **16,560** |

| Wetland number and description | Hydroperiod | Location | Size (m²) |
|---|---|---|---|
| **Wetlands to be constructed (Figure 6)** | | | |
| P1 | Permanent | Off-stream | 3052 |
| P2 | Permanent | Off-stream | 987 |
| P3 | Permanent | Off-stream | 1355 |
| P4 | Permanent | Off-stream | 818 |
| P5 | Permanent | Off-stream | 887 |
| P6 | Permanent | Off-stream | 852 |
| P7 | Permanent | Off-stream | 1946 |
| E1 | Permanent | Off-stream | 500 |
| E2 | Permanent | Off-stream | 440 |
| E3 | Permanent | Off-stream | 650 |
| I1 – Northern | Permanent | In-stream | 363 |
| I2 – North central | Permanent | In-stream | 453 |
| I3 – South Central | Permanent | In-stream | 451 |
| I4 – Southern | Permanent | In-stream | 557 |
| **Total wetlands constructed** | | | **13,311** |
| **Total off-stream wetlands prior to development** | | | **35,030** |
| **Total off-stream wetlands following development** | | | **26,687** |
| **Total in-stream wetlands prior to development** | | | **1,540** |
| **Total in-stream wetlands following development** | | | **3,184** |

**Updated Table 5**. Size of each Growling Grass Frog pond, and area of each pond that is shallow, intermediate and deep in meters and percentages.

| GGF Pond | | Total area | Shallow (0-0.05m) | Intermediate (0.5-1.5m) | Deep (1.5m) |
|---|---|---|---|---|---|
| Pond 1 | m² | 3052 | 1304 | 697 | 1051 |
| | % | | 43% | 23% | 34% |
| Pond 2 | m² | 987 | 307 | 355 | 325 |
| | % | | 31% | 36% | 33% |
| Pond 3 | m² | 1355 | 364 | 498 | 493 |
| | % | | 27% | 37% | 36% |
| Pond 4 | m² | 818 | 262 | 264 | 292 |

| GGF Pond | | Total area | Shallow (0-0.05m) | Intermediate (0.5-1.5m) | Deep (1.5m) |
|---|---|---|---|---|---|
| | % | | 32% | 32% | 36% |
| Pond 5 | $m^2$ | 887 | 259 | 242 | 386 |
| | % | | 29% | 27% | 44% |
| Pond 6 | $m^2$ | 852 | 336 | 246 | 270 |
| | % | | 39% | 29% | 32% |
| Pond 7 | $m^2$ | 1946 | 495 | 801 | 650 |
| | % | | 25% | 41% | 33% |

**Updated Table 6**. Maximum values for water quality parameters in Growling Grass Frog wetlands, taken from DELWP (2017b).

| Water Quality Parameter | Target Value |
|---|---|
| Total Nitrogen (mg/L) | < 1.0 |
| Ammonia (mg/L) | < 0.01 as NH4+ |
| Total phosphorous (mg/L) | < 0.1 |
| pH | 6.0-9.0 (adapted with information from Ecology Australia 2017b) |
| E.coli (organisms/100 ml) | Primary Contact < 150<br>Secondary contact < 1000 |
| Salinity (µS/cm) | < 5000 for all wetlands |
| Turbidity (NTUs) | < 40 |

# Updated Figures

ADELAIDE 22 Greenhill Rd Wayville SA 5034
BRISBANE Lvl 22 127 Creek St Brisbane Qld 4000
CANBERRA PO Box 6067 O'Connor ACT 2602
GEELONG 230 Latrobe Tce Geelong West Vic 3218
MELBOURNE 292 Mt Alexander Rd Ascot Vale Vic 3032
SYDNEY Lvl 5 616 Harris St Ultimo NSW 2007

www.ehpartners.com.au

ABN : 65 685 233 760

**Updated Figure 1**


**Figure 1**

**Project area boundaries and stages**

*Environmental Management Plan: 215, 315W and 325C Cooper Street, Epping*

**Legend**

Property area

**Stages**

Stage 1

Stage 2


N

0 40 80

Metres

Map Scale: 1:4,300 @ A4
Coordinate System:
GDA 1994 MGA Zone 55



*14592_Fig01_Staging 17/08/2023 melsley*

ecology & heritage partners

Aerial source: Nearmap 2023

**Updated Figure 2**


**Figure 2**
**Existing conditions and wetland**
*Environmental Management Plan: 215, 315W and 325C Cooper Street, Epping*

**Legend**
- Project area
- Existing wetlands


N

0 40 80
Metres

Map Scale: 1:4,300 @ A4
Coordinate System:
GDA 1994 MGA Zone 55



*14592_Fig02_ExistCondWL 17/08/2023 melsley*

ecology & heritage partners

Aerial source: Nearmap 2023

**Updated Figure 5**


Legend
EPPING RENEWAL SITE
URBAN QUARTER NORTH
URBAN QUARTER SOUTH
HEALTH QUARTER
LIVING QUARTER
DRAINAGE RESERVE
LIVING QUARTER
MIXED USE
URBAN QUARTER
SPECIAL USE ZONE
NORTH
HEALTH QUARTER
SPECIAL USE ZONE
EDGARS CREEK
WILLANDRA DRIVE
YALE DRIVE
FULLARTON DRIVE
COOPER STREET
MAIN ROAD
URBAN QUARTER NORTH
LIVING QUARTER
HEALTH QUARTER
MAIN STREET
EDGARS CREEK
EDGARS ROAD
URBAN QUARTER SOUTH
CENTRE ROAD
CONSERVATION QUARTER
PUBLIC CONSERVATION + RESOURCE ZONE
URBAN FLOODWAY ZONE
URBAN QUARTER
SPECIAL USE ZONE
SOUTH
DEVENY ROAD
EDGARS CREEK
HUSKISSON DRIVE

**Updated Figure 6**

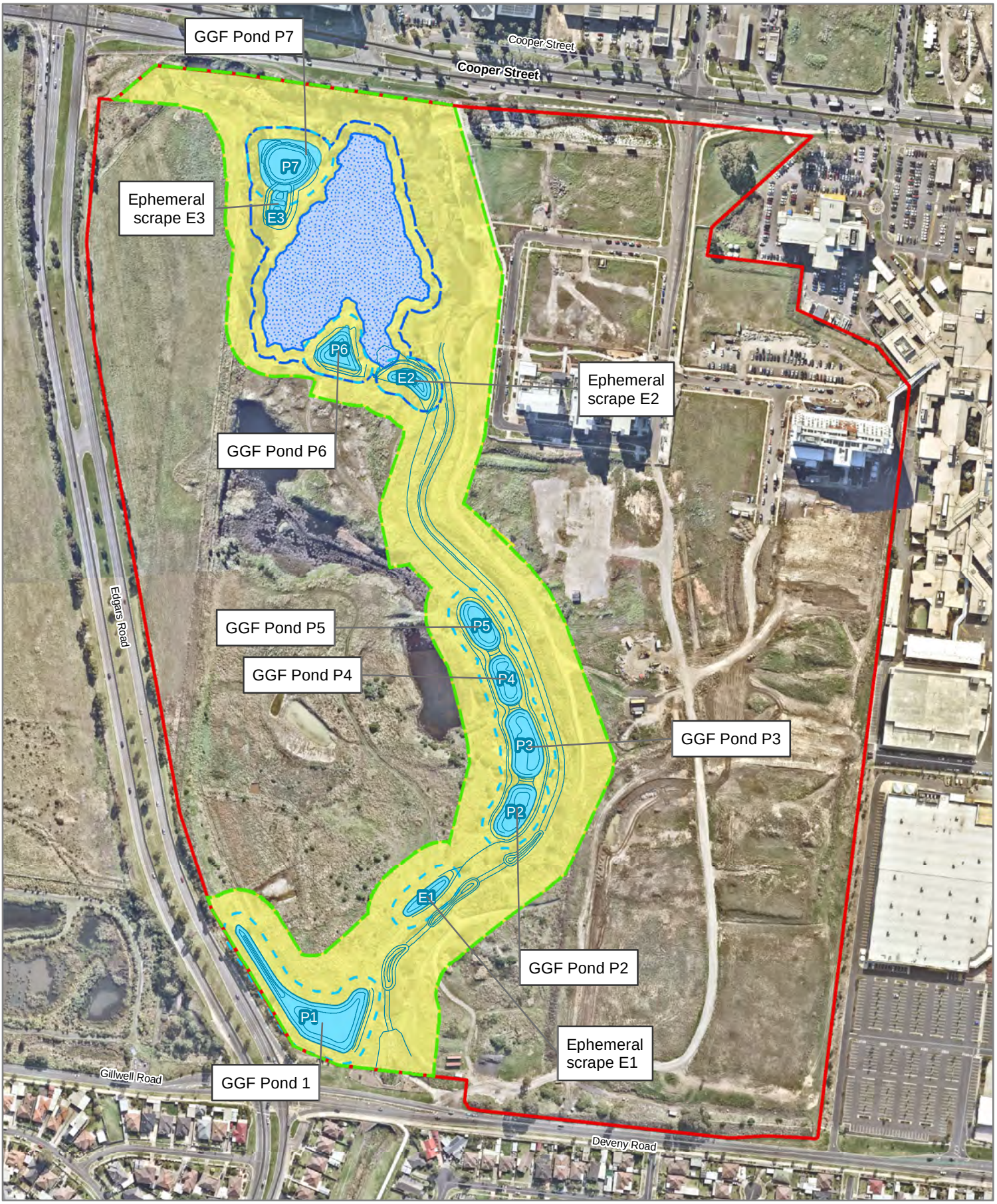



**Figure 6**

**Proposed onsite offset layout**

*Environmental Management Plan: 215, 315W and 325C Cooper Street, Epping*

**Legend**

- Project area
- VCAT Corridor Creek Boundary (23/01/17)
- Pond or ephemeral scrape
- 10m buffer (GGF wetland)
- Proposed Lake (Edgars Creek)
- Proposed Lake buffer
- GGF Terrestrial habitat


N

0 40 80
Metres

Map Scale: 1:4,300 @ A4
Coordinate System:
GDA 1994 MGA Zone 55



*14592_Fig06_PropOffset 26/10/2023 dvaladares*

ecology & heritage partners

Aerial source: Nearmap 2023

**Updated Figure 7**


NOTE:

The above plan is the indicative landscape masterplan of the proposed Edgars Creek Corridor, extracted from the Landscape Masterplan Report prepared by Tract dated 05.10.2023.

| Drawing Title | Project Name | Drawing No. | Revision | Date | Drawn | Checked | Project Principal | Scale |
|---|---|---|---|---|---|---|---|---|
| Landscape Masterplan | New Epping Edgars Creek Corridor | 316-0647-00-L-72-DR10 | 0 | 27.10.2023 | MC | MY | JG | 0 25 50 100 |

## Updated Figure 9

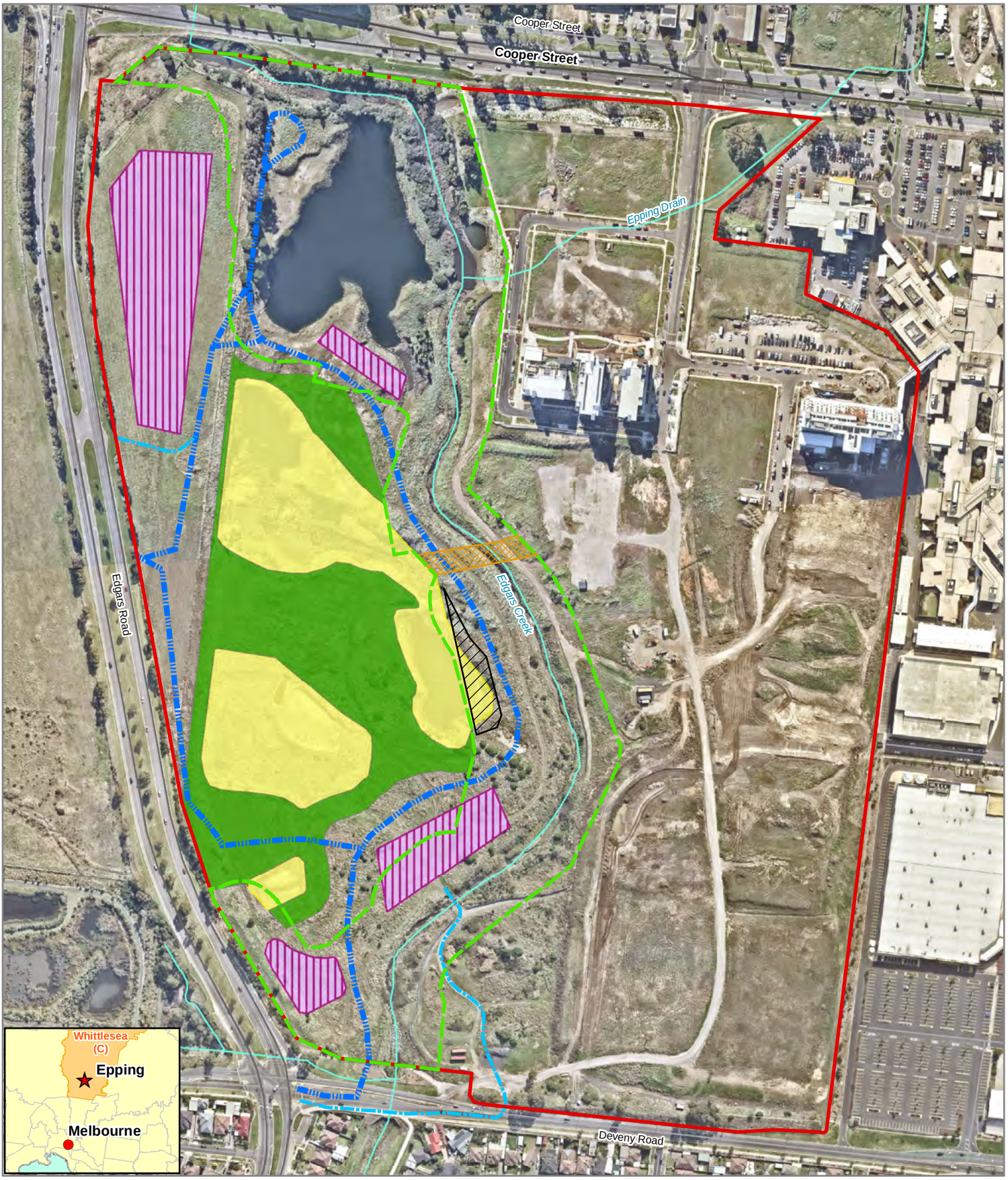



**Figure 9**
**Existing GGF habitat and areas of protection and removal**
*Environmental Management Plan: 215, 315W and 325C Cooper Street, Epping*

**Legend**

- Project area
- VCAT Corridor Creek Boundary (23/01/17)
- Heavy vehicle access (subject to VicRoads approval)
- Light vehicle access
- Lay-down areas (stockpile, materials etc.)
- Existing GGF habitat to be protected during habitat corridor construction
- GGF movement corridor (can include a haul road)
- Approximate area already nominated in the EMP as GGF area that can be reclaimed at commencement of works (to facilitate construction)
- Approximate location of road bridge structure

N

0 40 80
Metres

Map Scale: 1:4,300 @ A4
Coordinate System:
GDA 1994 MGA Zone 55

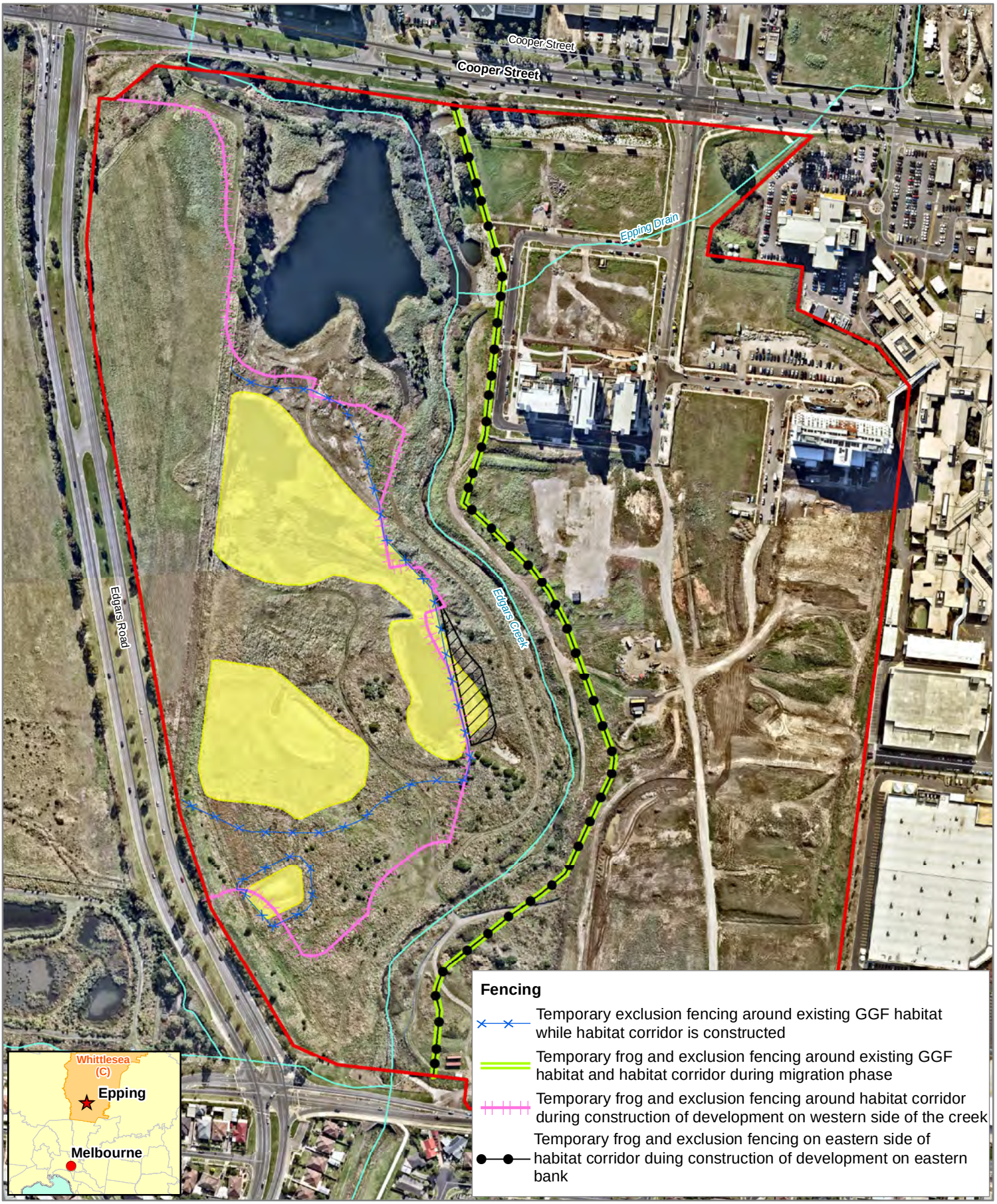


*14592_Fig09_GGF_habitat 24/06/2024 psorensen*

ecology & heritage partners

Aerial source: Nearmap 2023

**Updated Figure 12**




# Figure 12

**Indicative frog and exclusion fencing**

*Environmental Management Plan: 215, 315W and 325C Cooper Street, Epping*

## Legend

- Project area
- Existing GGF habitat to be protected during habitat corridor construction
- Approximate area already nominated in the EMP as GGF area that can be reclaimed at commencement of works (to facilitate construction)

N

0 40 80

Metres

Map Scale: 1:4,300 @ A4
Coordinate System:
GDA 1994 MGA Zone 55



*14592_Fig12_Fencing 27/10/2023 dvaladares*

ecology & heritage partners

Aerial source: Nearmap 2023

## Appendix 1 – Environmental Management Plan: 215, 315W and 325C Cooper St, Epping

ECOLOGY AUSTRALIA

# Environmental Management Plan: 215, 315W and 325C Cooper St, Epping

Prepared for: Verve Projects

## Document information

This is a controlled document. Details of the document ownership, distribution, status and revision history are listed below.

All comments or requests for changes to content should be addressed to the document owner.

| | | |
|---|---|---|
| **Owner** | Ecology Australia Pty Ltd | |
| **Project** | 16-069 | |
| **Author** | M. Le Feuvre & A McMahon | |
| **File** | 191015-EMP Final.docx | |
| **Bioregion** | Victorian Volcanic Plain | |
| **Distribution** | Tim Stephens | Verve Projects |
| | Cameron Delarue | Verve Projects |
| | Ben Rowe | Riverlee |
| | Richard Johnston | Riverlee |

**Document History**

| Status | Changes | By | Date |
|---|---|---|---|
| Draft 1 | First Draft | M Le Feuvre, A McMahon | 3/12/2018 |
| Draft 2 | Updated information | M Le Feuvre, A McMahon | 12/03/2019 |
| Draft 3 | Updated information | M Le Feuvre, A McMahon | 23/09/2019 |
| Final | Minor amendments | M Le Feuvre, A McMahon | 22/10/2019 |

Cover photo: Growling Grass Frog recorded at 215 Cooper St, Epping in 2019 (M Le Feuvre)

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# Contents

**Tables**



**Figures**

## Acknowledgments

We gratefully acknowledge the assistance of:

- Jamie McMahon — Ecology Australia
- Ben Rowe — Riverlee
- Richard Johnston — Riverlee
- Tim Stephens — Verve Projects
- Cameron Delarue — Verve Projects
- Mike Stokes — Tract Consultants
- Esther Ziebell — Tract Consultants
- Joanne Green — Tract Consultants
- Joe Miller-Norman — Cardno
- Ed Henty — Cardno

## Summary

Ecology Australia Pty Ltd was commissioned by Riverlee Caruso Epping Pty Ltd ("Riverlee") to prepare a Environmental Management Plan (EMP) for the redevelopment of 215, 315W and 325C Cooper Street, Epping ("New Epping") for residential and commercial uses.

The property at 215 Cooper Street comprises 45.5 ha of private land. The eastern portion of this property was used to quarry basalt, and subsequently as a landfill until 1998, after which it was capped and rehabilitated. The central and northern areas were also used to quarry basalt, leaving behind some large pits that are now a collection of permanent and ephemeral waterbodies (Figure 1). The adjoining properties to the west comprise c. 3.5 ha of Council owned private land (road reserve, 315W Cooper Street) and c. 2.1 ha of State owned public land (325D Cooper Street). These two properties do not appear to have undergone historic earthworks and are dominated by introduced Chilean Needle-grass **Nassella neesiana* which is maintained by mowing/slashing. Edgars Creek traverses from north to south across the site. A long history of stock grazing followed by quarrying and landfill activities has all but eliminated native vegetation, and the site is now severely degraded and overwhelmingly dominated by weed species.

Despite the severely degraded habitat present, the site supports a regionally significant population of Growling Grass Frog (*Litoria raniformis*) that inhabits the disused quarry pits. The Growling Grass Frog is listed as Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), listed as threatened under the *Flora and Fauna Guarantee Act 1988* (FFG Act) and is classified as endangered in Victoria (DSE 2013). The largest quarry pit is fed by groundwater and as a result provides permanent, off-channel habitat for the Growling Grass Frogs. Two more water bodies are near permanent, and provide good habitat for Growling Grass Frogs in most years. The remaining eight waterbodies are ephemeral, and provide habitat for Growling Grass Frogs in wet years.

In addition, a small population of Golden Sun Moth (*Synemon plana)* is present on site, primarily in Chilean Needle-grass dominated grasslands at 315W and 325C Cooper St. The Golden Sun Moth is listed as critically endangered under the Commonwealth EPBC Act, listed as threatened under the Victorian FFG Act and classified as critically endangered by DELWP. There is approximately 5.5318 ha of Golden Sun Moth habitat on site, the majority of which (5.508 ha) is at 315W and 325C Cooper St.

Riverlee proposes to remove the majority of Growling Grass Frog and all Golden Sun Moth habitat present on site as part of the development. Impacts to Golden Sun Moth will be offset offsite in the Western Grassland Reserve. Impacts to Growling Grass Frogs will be offset using a combination of offsite and onsite offsets. Management of the on-site offset during construction of the habitat corridor, the migration phase, adaptive management phase and removal of existing Growling Grass Frog habitat outside the habitat corridor make up the bulk of this EMP. Ongoing management of the onsite offset following the removal of Growling Grass Frog habitat outside the habitat corridor will be covered in the Offset Management Plan.

Riverlee proposes to construct an ~~11.44 ha~~ Growling Grass Frog habitat corridor along Edgars Creek, which will be remediated and revegetated. The habitat corridor will be specifically designed and managed for Growling Grass Frogs, and will include:

Refer to update #3

- The retained main quarry waterbody (1.52 ha)

- Ten constructed wetlands, designed specifically for Growling Grass Frogs. This includes seven permanent wetlands and three managed ephemeral wetlands (1.14ha).
- Riparian habitat (4.31 ha within 30 m of wetlands) and terrestrial habitat (~~3.8 ha~~) designed and managed specifically for Growling Grass Frogs.

Refer to update #4

Development across the site will be staged to enable the construction of the habitat corridor and to give Growling Grass Frogs the opportunity to migrate from existing habitat on site to constructed wetlands prior to any construction commencing in areas of Growling Grass Frog habitat. The habitat corridor and staged development underpin this EMP.

This EMP outlines management actions to minimise impacts to the environment as a result of this development. The actions include, but are not limited to the following:

- Staged development of the site as follows, and are explained below in further detail:
  - (i) protecting existing Growling Grass Frog habitat,
  - (ii) constructing and revegetating the habitat corridor
  - (iii) ~~a two year Growling Grass Frog migration phase and, if required, an additional adaptive management phase.~~
  - (iv) Construction commences in existing Growling Grass Frog habitat on site. Construction can only commence once criteria for successful Growling Grass Frog migration have been met. Salvage and relocation will occur immediately prior to any construction commencing in existing Growling Grass Frog habitat.
  - (v) ~~Post construction habitat management, to be outlined in a separate offset management plan.~~

Refer to update #5

Refer to update #6

- Establishing no-go zones in areas of existing Growling Grass Frog habitat.
- Remediating Edgars Creek to improve hydrological and ecological function.
- Construction of wetlands follows a specific design and configuration which largely aligns with Growling Grass Frog habitat design standards (DELWP 2017b & 2017c). Design and configuration includes:
  - Wetland layout including wetland spacing, number and type.
  - Wetland area.
  - Wetland design, including steepness of the banks, and areas of deep water, rock beaching and emergent vegetation.
  - Wetland riparian buffer and terrestrial corridor design, including dense vegetation and overwintering habitat such as rocks and logs within 10 m of water bodies, and more open habitat greater than 10 m from the habitat corridor.
  - Wetland water management, including constructing a water delivery system to ensure that wetlands remain permanent.
  - ~~Wetland water quality management, including maintaining lower salinity (<3,000 µS/cm) and higher salinity (<7,000 µS/cm) wetlands.~~

Refer to update #7

- Revegetation of the habitat corridor. Revegetation will be split into zones including terrestrial habitat, fringing vegetation, shallow emergent zone and deeper areas dominated by submergent and floating vegetation.
- Weed management
- A two breeding season long frog migration phase. For the migration phase to be successful, the following criteria must be met:
  - Successful Growling Grass Frog breeding demonstrated in two of the constructed wetlands.
  - Growling Grass Frogs present in four of seven constructed permanent wetlands.
  - If these criteria are not met after two breeding season, the adaptive management phase will commence.
- An adaptive management phase (if required). This phase may involve a number of measures including corrective habitat management, novel management techniques and, as a last resort, salvage and relocation.
- Construction outside Growling Grass Frog habitat areas (i.e. east of the habitat corridor)
- Construction in Growling Grass Frog habitat areas (i.e. west of the habitat corridor).
- Pest animal control, with particular focus on predatory fishes
- Chytrid control, including sterilising equipment, vehicles and footwear prior to entering Growling Grass Frog habitat areas and the habitat corridor.
- Infrastructure, including fencing, paths, roads, creek crossing, artificial lighting, artificial noise, shading and stormwater infrastructure.
- User related issues, arising from pedestrians, cyclists and pets following construction.
- Salvage and relocation of Growling Grass Frogs prior to clearing any Growling Grass Frog habitat
- Ongoing monitoring of the Growling Grass Frog population and habitat.
- Offsetting impacts to Golden Sun Moths.

This EMP contains a comprehensive risk assessment for the development of the site, and outlines the monitoring, reporting, auditing and EMP review requirements for the project.

Finally this EMP outlines the environmental management roles and responsibilities, environmental training requirements and emergency contacts and procedures.

Refer to update #8

~~This EMP will remain in force until the habitat corridor is successfully established, the migration and adaptive management phase are complete and existing Growling Grass Frog habitat outside the habitat corridor is removed, when it will be replaced by an onsite Offset Management Plan (OMP).~~

# 1 Introduction

Ecology Australia Pty Ltd was commissioned by Riverlee Caruso Epping Pty Ltd ("Riverlee") to prepare an Environmental Management Plan (EMP) for the redevelopment of 215, 315W and 325C Cooper Street, Epping ("New Epping") for residential and commercial uses (Figure 1). The proposed New Epping development has two stages:

- Stage 1 is the redevelopment of the former Epping Quarry and landfill site at 215 Cooper Street, Epping. The privately owned site is approximately 45.5 ha, and was once a quarry and landfill that has now been capped. The site is traversed by Edgars Creek and the former quarry holes and associated waterbodies support a population of Growling Grass Frogs (*Litoria raniformis*). The Growling Grass Frog is listed as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), listed as threatened under the Victorian *Flora and Fauna Guarantee Act 1988* (FFG Act) and classified as endangered by the Department of Environment, Land, Water and Planning (DELWP) (DSE 2013).
- Stage 1 now also includes 315W Cooper Street (~3.5ha) which was acquired by Riverlee from the City of Whittlesea (August 2019). The boundary plan at Figure 1 has been updated to reflect this. Note this is a change to the staging plan including in the Preliminary Documentation. This site contains known habitat for the Golden Sun Moth (*Synemon plana*). The Golden Sun Moth is listed as critically endangered under the Commonwealth EPBC Act, listed as threatened under the Victorian FFG Act and classified as critically endangered by DELWP (DSE 2009).
- Stage 2 is the redevelopment of 325C Cooper Street (~2.1 ha of State-owned public land which the approval holder is in the process of acquiring). There is uncertainty regarding the development of this stage as the land is owned by State Government. This site contains known habitat for the Golden Sun Moth (*Synemon plana*). The Golden Sun Moth is listed as critically endangered under the Commonwealth EPBC Act, listed as threatened under the Victorian FFG Act and classified as critically endangered by DELWP (DSE 2009).

The proposed redevelopment has been approved by the Department of the Environment and Energy (DoEE) based on Preliminary Documentation (Referral 2016/775) (Ecology Australia 2018). This EMP provides further detail regarding implementation of the mitigation measures and contingency actions outlined in the preliminary documentation, to ensure the protection and enhancement of EPBC Act-listed species habitat and populations prior to, during and following the proposed action.

This EMP has been submitted to the DoEE for approval in accordance with Condition 4 of the approval conditions.

Refer to update #9

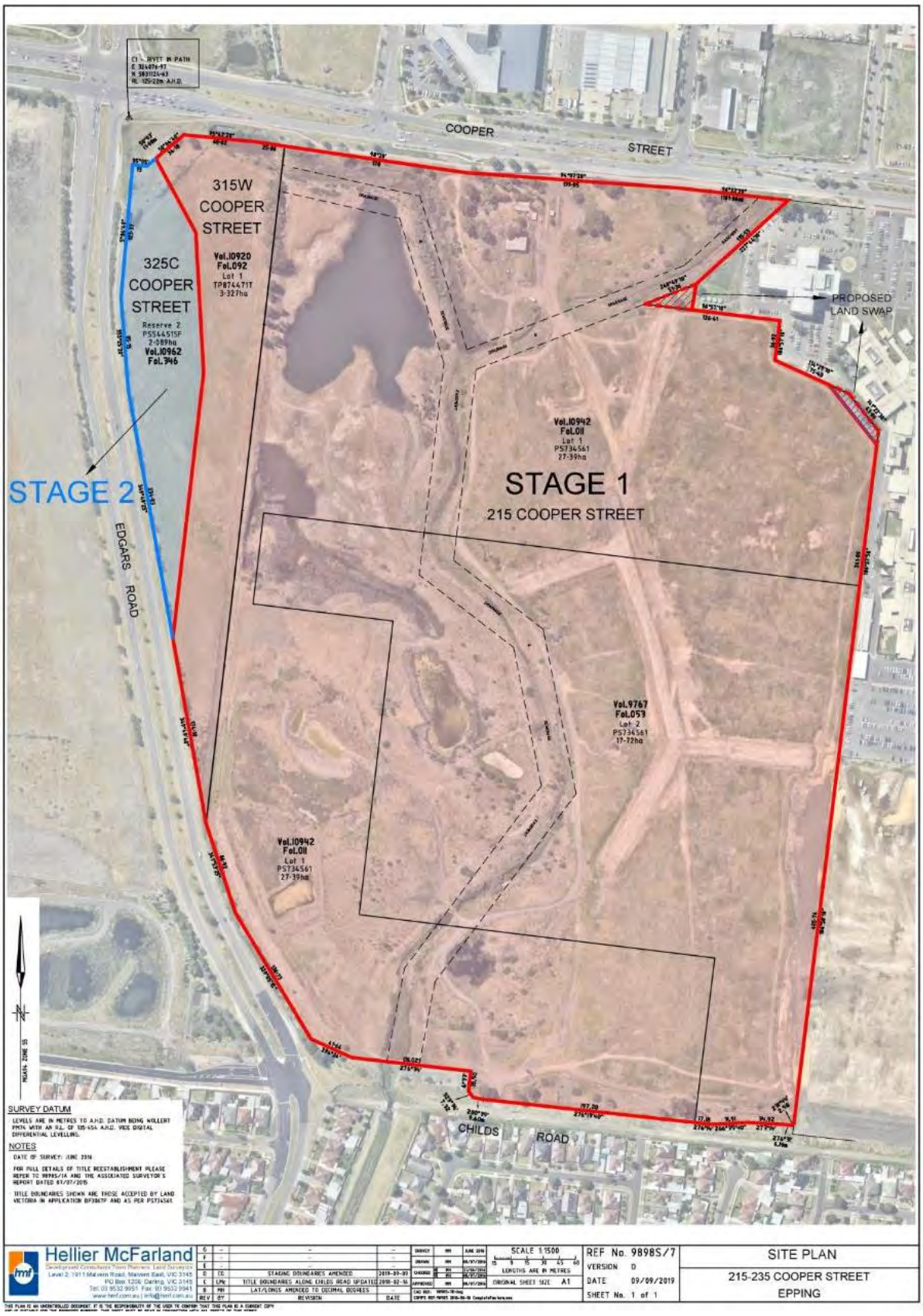



**Figure 1 Project area boundaries of the New Epping site, showing Stages 1 and 2 of the proposed development**

# 2 Conditions of Approval

This EMP has been specifically developed to comply with the approval conditions outlined in the approval EPBC 2016/7755. The relevant approval conditions are outlined in Table 1.

**Table 1 EPBC approval conditions for the New Epping development (EPBC 2016/7755).**

| Condition | Condition details | EMP Actions | EMP section |
|---|---|---|---|
| 3 | To compensate for the loss of ~~17.39 ha~~ of **Growling Grass frog habitat**, the approval holder must implement the **Growling Grass Frog Offset Strategy**, and ensure that a **viable population** of the **Growling Grass Frogs** is maintained at the proposed offset areas for 10 years. | Offsets secured in perpetuity | 3, 7, 10 |
| 4 | Prior to the **commencement of the action**, the approval holder must prepare Offset Management Plans for the onsite and offsite offset areas proposed in the **Growling Grass Frog Offset Strategy**. The approval holder must not **commence the action** until both Offset Management Plans have been prepared. The Offset Management Plans must be provided to the **Department** within 14 days the Offset Management Plans being prepared. Each approved Offset Management Plan must be implemented for the life of the approval. Each Offset Management Plan must: | This report | N/A |
| 4a | Be prepared by a **suitably qualified expert** | Report written by suitably qualified and experienced ecologists. | N/A |
| 4b | Be prepared in accordance with the principles of the **EPBC Act Environmental Offsets Policy**, and be consistent with the **Growling Grass Frog Offset Strategy** | Yes | N/A |
| 4c | Include timelines and mechanisms for **legally securing** the offset area(s) | ~~By 2019~~ | 4.2.3 |
| 4d | Provide a written description and a map that clearly defines the location and boundaries of the offset area(s). This must be accompanied by the offset **attributes** and **shapefiles(s)** | Description of site and map provided.<br>Attributes and shapefiles to be attached separately | 3, Figure 9 |
| 4e | Include a description, based on adequate surveys, of the current **Growling Grass Frog** population within each offset area, and the condition (prior to any management activities) of each offset area, including existing habitat (the baseline conditions) | Site description including current Growling Grass Frog population and habitat included. | 3, 4.1.1 |
| 4f | Detail timeframes, management actions, and strategies for:<br>i) maintaining a **viable population** of **Growling Grass Frogs** within the onsite offset; and<br>ii) for the creation, regeneration and/or revegetation of **Growling Grass Frog habitat** within the proposed onsite and offsite offset areas. | Management actions outlined to preserve and improve the Growling Grass Frog population and habitat on site | 7, 10 |

Refer to update #10

Refer to update #11

| Condition | Condition details | EMP Actions | EMP section |
|---|---|---|---|
| 4g | Management actions and strategies must include:<br>i) performance and completion criteria for evaluating the management of the offset area, and criteria for triggering remedial action and contingency responses<br>ii) a program to monitor and report on the effectiveness of these measures, and progress against the performance and completion criteria<br>iii) a description of potential risks to the successful implementation of the plan, a description of the measures that will be implemented to mitigate against these risks and a description of the contingency measures that will be implemented if defined triggers arise<br>iv) specify the timing and frequency of management actions, reporting and implementation of contingency responses and corrective actions, and the person/s responsible | Management actions with performance criteria outlined to preserve and improve the Growling Grass Frog population and habitat on site.<br>Monitoring and reporting program included.<br>Risk assessment completed.<br>Management responsibilities outlined<br>Potential corrective actions outlined | 7, 8, 10, 11, 13 |
| 6 | Within three (3) months following the third and fourth anniversary of the **commencement of the action**, the approval holder must provide a report demonstrating that a **viable population** of **Growling Grass Frog** has been maintained at the onsite offset site (as required under the **Growling Grass Frog Offset Strategy**). The report must be prepared by a **suitably qualified expert**. | Annual Growling Grass Frog monitoring report | 10, 11 |
| 7 | If the **Minister** is not satisfied that a **viable population** of **Growling Grass Frog** has been maintained, as required in condition 6, the **Minister** may (in writing) require the approval holder to submit a new plan or program for the **Minister's** approval to reduce, mitigate, remediate or compensate impacts to **Growling Grass Frogs**. If the **Minister** approves the plan or program, then the approved plan or program must be implemented. *Note: To avoid doubt, any proposed compensation measures must be additional to that required by the **Growling Grass Frog Offset Strategy***. | Potential corrective actions included in management actions<br>EMP review as required. | 7, 11 |
| 10 | All management plans required under this approval should be prepared in line with the **Department's Environmental Management Plan Guidelines**. | EMP follows guidelines. | N/A |
| 11 | The approval holder must maintain accurate and complete **compliance records**. | Reporting schedule included | 11 |
| 15 | The approval holder must prepare a **compliance report** for each 12 month period following the date of **commencement of the action**, or as otherwise agreed to in writing by the **Minister**. | Reporting schedule included | 10, 11 |
| 16 | The approval holder must notify the **Department** in writing of any: **incident;** non-compliance with the conditions; or non-compliance with the commitments made in **plans**. The notification must be given as soon as practicable, and no later than two **business days** after becoming aware of the **incident** | Incident reporting section provided, with relevant emergency contacts. | 13 |

| Condition | Condition details | EMP Actions | EMP section |
|---|---|---|---|
| | or non-compliance. The notification must specify:<br>a. the condition which is or may be in breach; and<br>b. a short description of the **incident** and/or non-compliance. | | |
| 17 | The approval holder must provide to the **Department** the details of any **incident** or non-compliance with the conditions or commitments made in **plans** as soon as practicable and no later than 10 **business days** after becoming aware of the **incident** or non-compliance, specifying:<br>a. any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;<br>b. the potential impacts of the incident or non-compliance; and<br>c. the method and timing of any remedial action that will be undertaken by the approval holder. | Incident reporting section provided, with relevant emergency contacts. | 13 |
| 18 | The approval holder must ensure that **independent audits** of compliance with the conditions are conducted for the 12 month period from **commencement of the action** and for every subsequent 24 month period until this approval expires, or as requested in writing by the **Minister**. | Audit reporting schedule reflects condition | 11 |
| 21 | The approval holder may, at any time, apply to the **Minister** for a variation to an action management plan approved by the **Minister** under condition 4, or as subsequently revised in accordance with these conditions, by submitting an application in accordance with the requirements of section 143A of the **EPBC Act**. If the **Minister** approves a revised action management plan (RAMP) then, from the date specified, the approval holder must implement the RAMP in place of the previous action management plan. | EMP review process outlined. | 13 |

Commencement of the action (also commence the action) is defined as *"the first instance of any specified activity associated with the action (inside of the Impact Area) including clearance of vegetation and construction of any infrastructure. Commencement does not include minor physical disturbance necessary to:*

(i) *undertake surveys or monitoring programs;*

(ii) *install signage and/or temporary fencing to prevent unapproved use of the project area;*

(iii) *protect environmental and property assets from fire, weeds and pests, including erection or construction of fencing and signage, and maintenance or use of existing surface access tracks, if agreed in writing by the Department; and*

(iv) *manage traffic".*

For the purpose of this document, the 10 year management period is defined as the 10 years following the completion of the habitat corridor.

# 3 Study Area

The study area of 51 ha is located in Epping roughly 19 km north of the Melbourne CBD in the City of Whittlesea. The property is bounded by Cooper Street to the north, the Northern Hospital and Costco to the east, Deveny Road to the south and Edgars Road to the west.

The property at 215 Cooper Street comprises 45.5 ha of private land. The eastern portion of this property was used to quarry basalt and subsequently as a landfill until 1998, after which it was capped and is now rehabilitated. The western portion was largely used to quarry basalt, leaving behind some large pits that now form a collection of permanent and ephemeral waterbodies.

The adjoining properties to the west comprise c. 3.5 ha of Council owned private land (road reserve, 315W Cooper Street) and c. 2.1 ha of State owned public land (325C Cooper Street). These two properties do not appear to have undergone historic earthworks and are dominated by introduced Chilean Needle-grass (**Nassella neesiana*) which is maintained by mowing/slashing.

The pre-European vegetation of the study area was dominated by Plains Grassland and Plains Grassy Woodland Ecological Vegetation Classes (EVCs). A long history of stock grazing followed by quarrying and landfill activities has all but eliminated native vegetation, and the site is now severely degraded and overwhelmingly dominated by exotic flora species.

An on-site assessment in February 2015 identified 2 ha of native vegetation, based on the Victorian *Native Vegetation Permitted Clearing Regulations*, including remnant patches of native vegetation and scattered trees. Creekline Grassy Woodland EVC is found along the northern part of Edgars Creek, which has undergone extensive rehabilitation by Melbourne Water 2009/2010 (Ecology Australia 2015). Areas of Aquatic Herbland EVC occur downstream of the Creekline Grassy Woodland along Edgars Creek, while Tall Marsh EVC was observed along the channels of Edgars Creek and Epping Drain. There were also some areas of Plains Grassy Woodland EVC, Heavier-Soils Plains Grassland EVC and Stony Knoll Shrubland (EVC 649) on the plains, and Plains Sedgy Wetland (EVC 647) in some artificial depressions created as part of the quarry and rehabilitation works for the landfill. Fifteen scattered trees were identified onsite and would have once formed part of the Plains Grassy Woodland. The remainder of the site comprised exotic grasslands, planted exotic trees and waterbodies.

The project area is within the Edgar's Creek catchment, a sub-catchment of Merri Creek. Edgar's Creek is an ephemeral stream with an upstream catchment area of approximately 1,400 hectares; the length of creek within the site is approximately 1.2 km. Water quality monitoring shows no change upstream to downstream of the project area.

The project area also contains ten mostly man made off stream wetlands, including the former quarry pits (Figure 2). These wetlands vary in size from 230 $m^2$ to 15,200 $m^2$ and some are permanent, whereas others are ephemeral. There are two small in channel wetlands along Edgar's Creek.

The subject landform includes gentle slopes on the capped landfill, steep slopes on former quarry holes, spoil dumps and generally a gentle gradient along Edgars Creek. The history of quarrying and landfill on site has resulted in gross changes to soil profiles and intact soil profiles of clays or clayey loams over basalt now form a minor part of the site.

The study area occurs within the Victorian Volcanic Plain Bioregion, and the geology is comprised of Quaternary Newer Volcanics with grey loamy clay soils, which form heavier cracking clays in low-lying areas.

The study area receives an average annual rainfall of 652.5 mm (Bureau of Meteorology 2018).

### City of Whittlesea Planning Scheme

With the exception of the small pocket of public land along the western boundary at 325C Cooper Street, the study area is private property and owned by Riverlee. The majority of the site is currently in an Industrial Zone 3, with an Urban Floodway Zone along Edgars Creek and Epping Drain, and a Priority Development Zone (Schedule 1) in the small pocket of public land at 325C Cooper Street. A Land Subject to Inundation Overlay applies to the Urban Floodway Zone.

The study area is currently the subject of Planning Scheme Amendment C213 to rezone the site to a Special Use Zone (Schedule 7), Mixed Use Zone, Public Conservation and Reserve Zone and Urban Floodway Zone.

# 4 Background information

## 4.1 Ecology of threatened species

Desktop and field flora and fauna surveys identified populations of two threatened species in the study area, the Growling Grass Frog and the Golden Sun Moth (Ecology Australia 2015; Wildlife Profiles 2015; Ecology Australia 2016a, 2017a).

### 4.1.1 Growling Grass Frog *Litoria raniformis*

#### Distribution and Habitat requirements

The Growling Grass Frog is a large tree frog belonging to the 'bell frog' species complex (Hylidae). It is generally olive to bright green in colour, with a white, granular underbelly. The dorsal surface is typically warty with irregular brown to bronze spotting and a pale mid-dorsal stripe.

The Growling Grass Frog was formerly common and widespread across south eastern Australia including Tasmania. In Victoria, Growling Grass Frogs were once widespread, absent only from the western desert and alpine regions. However, the species has suffered significant declines in distribution and abundance across its range, including across much of southern and central Victoria where populations have experienced widespread declines and local extinctions (Tyler 1997; Mahoney 1999; Robertson *et al.* 2002).

Habitat requirements for the Growling Grass Frog are broad, and include a diverse range of wetlands and connecting habitat with opportunities to move between them (Robertson *et al.* 2002; Heard *et al.* 2004). The Growling Grass Frog has generally been recorded in or around shallow and still or slow-moving waters that supports a high level of aquatic vegetation (e.g. fringing, emergent and submerged vegetation) (Tyler 1997; Pyke 2002; Robertson *et al.* 2002). During the breeding season, aquatic vegetation provides calling platforms for males. Emergent vegetation provides areas for egg deposition and development, while submerged vegetation provides cover from predation for developing tadpoles. Fringing vegetation and grassy banks also provide foraging habitat and shelter. During the non-breeding season (April to September), terrestrial environments with rocks, logs or dense ground layer vegetation such as grass tussocks are important for providing shelter and over-wintering sites.

The Growling Grass Frog is highly mobile and displays classic metapopulation dynamics (Heard, Scroggie, and Malone 2012). At a landscape scale, drainage lines, low-lying areas, creeks and rivers that are near breeding sites, are important for enabling dispersal, movement between wetland sites, and the passage of individuals between sub-populations. A number of suitable wetlands in close proximity to one another (e.g. < 500 m apart), are essential to allow for dispersal, provided there are no or few barriers such as sealed roads or housing (Heard *et al.* 2010).

Breeding populations of Growling Grass Frogs have been historically observed in the study area (Robertson *et al.* 2002; Heard *et al.* 2004; Wildlife Profiles 2015; Ecology Australia 2017a). Growling Grass Frogs have been recorded within the site on several occasions in the last 17 years, and the species is also regularly recorded along Edgars, Darebin, Central and Merri creeks within 5 km of the study site (DELWP 2017a)(Figure 3).

Within the last five years the Growling Grass Frog has been recorded on several occasions within and surrounding two nearby stormwater treatment wetlands; one immediately north of the site on Edgars

Creek, and another wetland entering the previous wetlands from the west, approximately 600 m from the site (D. Gilmore, pers. comm.) (Figure 3). Successful breeding was recorded from the stormwater treatment area directly to the north of the site in the 2016/17 active season (D. Gilmore, pers. comm.). Growling Grass Frogs have also been recorded at the adjacent Melbourne Market relocation site and at another disused quarry in close proximity to Central Creek within 2 km of the study site (DELWP 2017a).

The species has also been recorded along Merri Creek north of Cooper St, c. 4 km north-west of the study site (DELWP 2017a). Growling Grass Frogs have also been recorded in the last ten years further north along Edgars Creek and adjacent wetlands, c. 4 km upstream of the study site, and along Darebin Creek c. 4.5 km south-east of the study site.

Recent surveys for Growling Grass Frogs have been undertaken within the project area over the summers of 2014/15, 2016/17 and 2018/19 (Wildlife Profiles 2015; Ecology Australia 2017a, 2019a).

### Distribution in the project area

The local Growling Grass Frog population appears to vary substantially based on prevailing conditions. Surveys were conducted over the 2014/2015 breeding season when conditions were dry, and again in 2016/17 when conditions were more favourable (i.e. wetter).

In 2014/15, Growling Grass Frogs were detected at seven of the twelve waterbodies, including evidence of breeding at two sites. Most observations were of single or few (three or less) frogs, with no records obtained from two surveyed pools on Edgars Creek (Wildlife Profiles 2015). Totals of between eight and 27 frogs were recorded during each survey in 2014/15.

In the 2016/17 season, Growling Grass Frogs were recorded at eight of the 12 wetlands and in-stream pools, similar to wetland occupancy in 2014/15 (Ecology Australia 2017a). However, frog abundance was higher than 2014/15, with totals of between 50 and 84 frogs recorded during each of the three survey periods. Evidence of breeding was recorded at three of the wetlands.

During the 2018-2019 breeding season, only wetlands 1, 2 and 3 contained water due to low rainfall. Despite dry conditions, up to 91 frogs were recorded during surveys. Up to 54 frogs were recorded in the main quarry water body. Two frogs were also recorded at wetland 12. Evidence of breeding was only recorded at wetland 2 (Ecology Australia 2019a).

Over the three breeding seasons, Growling Grass Frogs were recorded at 9 of the 12 wetlands (wetlands 1-4, 6-9 and 12, Figure 2) and evidence of breeding was found at 4 wetlands (wetland 2, 3, 4 and 8, Figure 2). The majority of individuals were recorded in wetlands 1 to 3, and most breeding recorded in wetlands 2 and 3.

Wetlands occupied by adult frogs and where breeding occurred had salinity levels between 4–7 mS/cm; wetlands where potentially dispersing sub-adult frogs were recorded had salinity levels up to approximately 20 mS/cm.

### Threatening Processes

Factors that have contributed to the decline of Growling Grass Frog across its range include habitat loss, the fragmentation and degradation of habitat (such as realigning watercourses, removing wetlands, removal of vegetation, modification of vegetation structure by exotic flora, and changes to hydrological regimes), predation by introduced species (including predation of eggs and tadpoles by introduced fish, such as Eastern Gambusia *Gambusia holbrooki*), salinisation, pollution of waterbodies and waterways by

fertilisers, pesticides and toxicants, and infection by the amphibian chytrid fungus *Batrachochytrium dendrobatidis*.

While many of these factors are presently impacting populations across the north of Melbourne, it is likely that habitat loss, fragmentation and degradation are major, if not the critical, factors threatening this species in the region (Heard *et al.* 2010).


Refer to update #12

**Figure 2 Epping Quarry site – existing conditions and wetlands (from Wildlife Profiles 2015)**

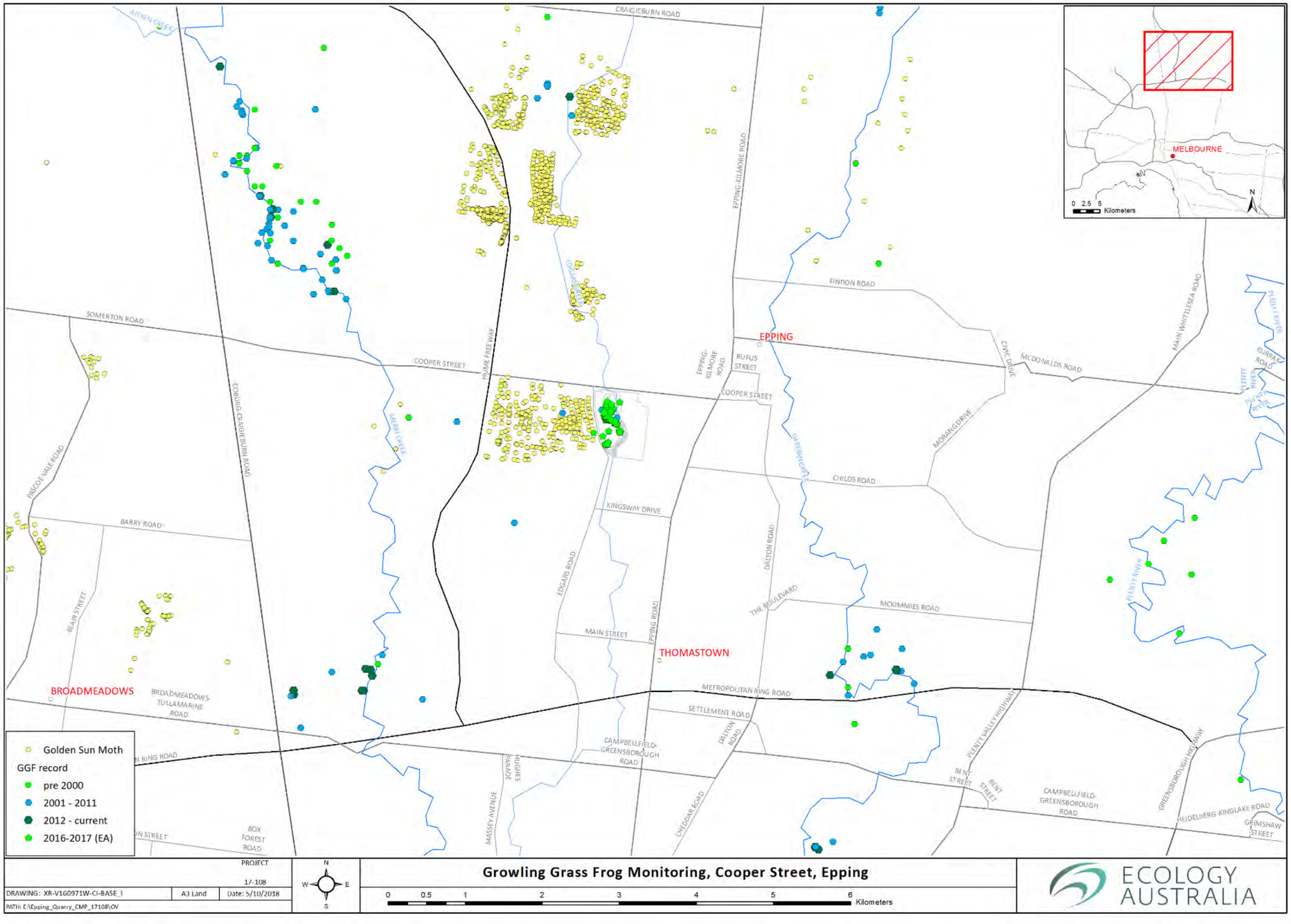



**Figure 3 Distribution of previous Growling Grass Frog and Golden Sun Moth records within approximately 5km of the New Epping site (source: DELWP 2017c and unpublished records)**

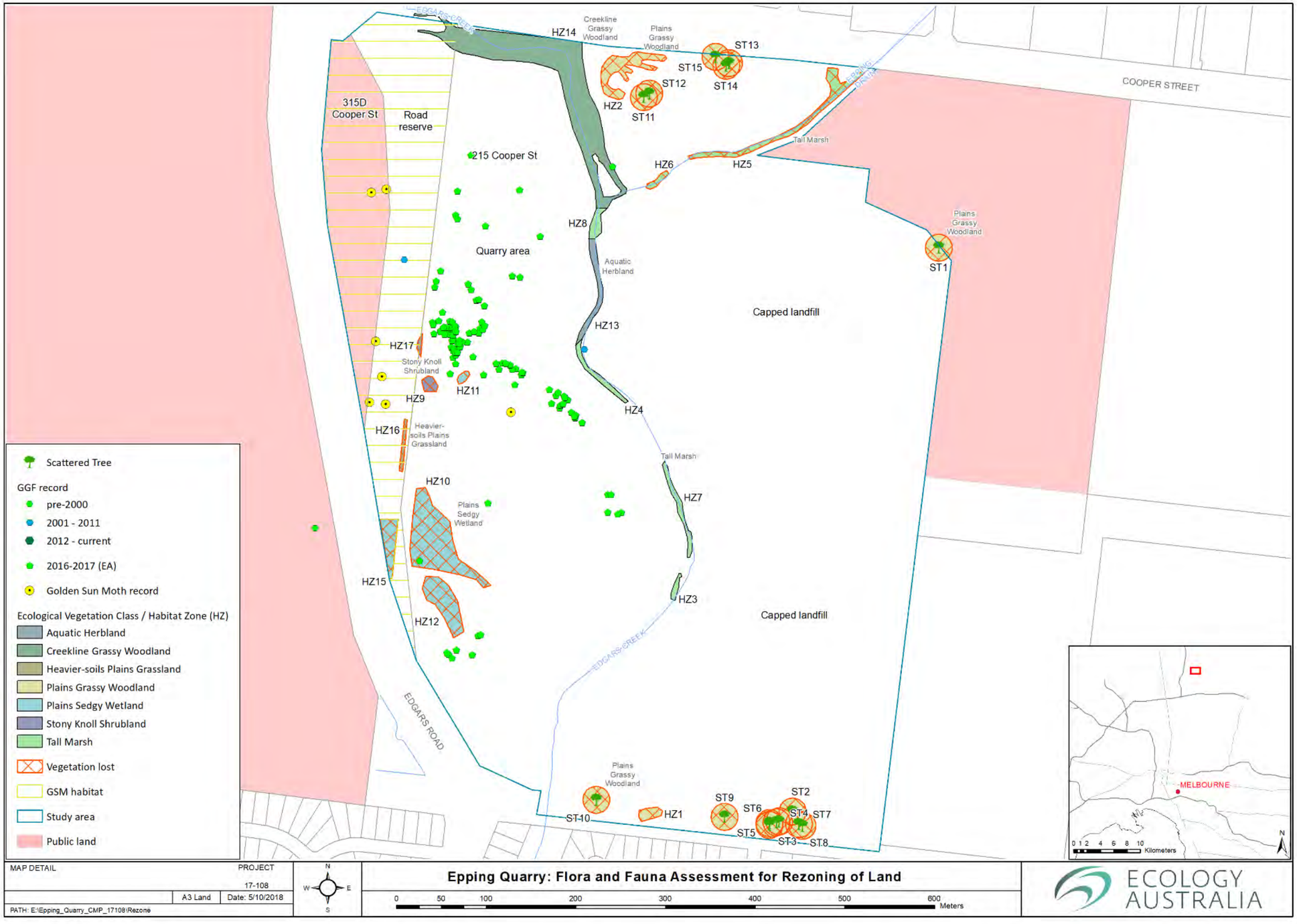



**Figure 4 Location of Growling Grass Frog and Golden Sun Moth records, land tenure, ecological vegetation communities, habitat zones and scattered trees at the New Epping site.**

### 4.1.2 Golden Sun Moth

#### Distribution and habitat requirements

The Golden Sun Moth is a medium-sized, diurnal (day-flying) moth belonging to the family Castniidae. Females have grey forewings and bright orange to gold hind-wings, while males have dark brown forewings with grey scales and duller bronze-brown hind-wings. Both males and females have clubbed antennae.

The Golden Sun Moth inhabits native grasslands and grassy woodlands in temperate south-eastern Australia, which are typically dominated by Wallaby-grasses or Spear-grasses (DEWHA 2009a) and have an open tussock structure with few shrubs. Some populations have also been recorded in degraded grasslands dominated by the exotic Chilean Needle-grass **Nasella neesiana* (Bainbridge *et al.* 2006; Endersby and Koehler 2006). The Golden Sun Moth was probably once widespread across grassland habitats, but since European settlement, the loss, disturbance and fragmentation of native grasslands has resulted in local extinctions throughout the range of this species and has greatly reduced its distribution (O'Dwyer 2004; Endersby and Koehler 2006).

Golden Sun Moth eggs are laid on the aforementioned grass species and the larvae burrow into the base of the plant and feed on their roots (ACT Government 1998). The density and diversity of Wallaby-grasses at a site are thought to be important for larval development. Adult Golden Sun Moths begin emerging in late October – early November, depending on local conditions, and are typically active during the warmest parts of the day until early-January (Cook and Edwards 1993; Gibson and New 2007). Adults lack functional mouthparts so cannot feed, and therefore only live for three to five days following emergence. As such, there are generally multiple cohorts of moths which emerge during warm days over the flight season (O'Dwyer and Attiwill 2000), which typically lasts from late October or early November until late December or January.

Female Golden Sun Moths have reduced hind wings and do not fly as readily as the males. Males have a distinct, erratic patrolling flight pattern which aims to seek out females displaying their golden hind wings on patches of bare ground (i.e. inter-tussock spaces). Adult male moths typically do not fly more than 100 m from suitable habitat, while populations separated by more than 200 m can be considered effectively isolated, and are unlikely to be recolonised in the event of local extinction (Clarke and O'Dwyer 2000).

The Golden Sun Moth has been recorded within the project area and at adjoining sites. At the Melbourne Markets site, directly to the west of the study site, surveys in 2008 recorded Golden Sun Moths across the property, prior to development of the site (DELWP 2017a) (Figure 3). Golden Sun Moths have been recorded in low numbers, during most years at the Melbourne Market site since its partial development (Ecology Australia, unpubl. data); remaining areas supporting Golden Sun Moths at this site will be developed in the near future.

Where systematic surveys have taken place, observations suggest Golden Sun Moths are broadly distributed across grasslands in and around Epping (DELWP 2017a) (Figure 3). Hundreds of records have been obtained from undeveloped pasture north and south of Harvest Home Road in Epping North (DELWP 2017a). A conservation area has been established to protect Golden Sun Moth values at O'Hearns Road in Epping as part of the Biodiversity Conservation Strategy for Melbourne's Growth

Corridors. The species has been recorded on multiple occasions along O'Hearns Road in the last ten years (DELWP 2017a).

Golden Sun Moths have also been recorded at Cooper Street Grassland Reserve on the western side of Merri Creek, c. 2.6 km west of the study area (Endersby and Koehler 2006; Gibson 2008; Gilmore *et al.* 2008; DEPI 2015) and on the adjoining eastern side of Merri Creek at 505A Cooper Street Epping, including in December 2014 (Ecology Australia 2009, 2014, Ecology Australia unpub. data).

### Distribution in the Project Area

Surveys for Golden Sun Moth were undertaken within the project area in December 2014, following protocols outlined in the significant impact guidelines (DEWHA 2009a). They had previously been recorded at 325C Cooper St by Daniel Gilmore of Biosis (Alan Webster, DELWP, pers. comm.).

Golden Sun Moths were recorded in the following areas in December 2014 (Ecology Australia 2015):

- One Golden Sun Moth in exotic grassland in the central section of 215 Cooper Street, immediately to the south of the second wetland and c. 140 m east of the closest record obtained at 325D Cooper Street (Figure 4); and
- Six Golden Sun Moth in *Chilean Needle-grass-dominated managed grassland at 325C Cooper St and the Council-owned road reserve (Figure 4).

There is 5.5318 ha of Golden Sun Moth habitat at 215, 315W and 325C Cooper St comprising:

- 0.0238 ha of Stony Knoll Shrubland at 215 Cooper St;
- 5.508 ha of habitat at 325C Cooper St including:
  - 5.478 ha of *Chilean Needle-grass exotic grassland;
  - 0.022 ha of the Heavier-soils Plains Grassland; and
  - 0.0085 ha of Stony Knoll Shrubland.

Habitat at 315W and 325C Cooper Street is considered to represent the primary area for Golden Sun Moth in the study area. Other potential habitats at 215 Cooper Street, include small patches of Plains Grassy Woodland in the north and south of the property, and rank exotic grassland. These habitats are either (a) too small and too far removed from Golden Sun Moth records, or (b) too densely vegetated to be suitable. No records were obtained on the rehabilitated grassland of the capped landfill, suggesting that this habitat is not suitable for the Golden Sun Moth (Ecology Australia 2015).

Habitat suitability for the Golden Sun Moth in the study site was considered to be 'high', based on the December 2014 records of the species and presence of confirmed habitat at 315W and 325C Cooper Street (Ecology Australia 2015). However, suitable habitat is restricted to these two parcels of land comprising the Stage 2 area.

### Threatening Processes

The principal threats to the Golden Sun Moth are habitat loss and degradation, and soil disturbance. Temperature grassland habitats occupied by the Golden Sun Moth are the most threatened vegetation types in Australia. Ninety-nine percent of temperate grasslands have been cleared for urban development and agriculture. The remaining patches have been heavily degraded through processes including grazing, trampling, invasive species and pasture improvement. Soil disturbance, through

processes such as cultivation and excavations for infrastructure, kills the fossorial Golden Sun Moth larvae and removes their perennial native grass host plants.

These threats are exacerbated by other processes including the Golden Sun Moth's limited dispersal capacity and their high risk of predation (DoEE 2017).

## 4.2 Development proposal

### 4.2.1 Vision

The vision for the site is to create a master-planned mixed-use precinct integrated with the adjoining medical, retail, residential and commercial zones surrounding the site. The New Epping development aims to deliver a 300-bed private hospital, 200 aged care beds, 200 retirement living units, 2,000 new private residences, 80,000 $m^2$ for commercial activities and ~~11.44 hectares~~ of natural environment. Figure 5 outlines the Concept Design for the development.

Refer to update #13

Note that the much of the development proposal outlined below has been approved under EPBC Act Approval 2016/7755 (Ecology Australia 2018).

### 4.2.2 Precincts

Development will occur in accordance with the Development Plan to be prepared for Planning Scheme Amendment C213 and will generally feature high density, health, commercial and residential uses east of Edgars Creek, and mid-density predominantly residential uses west of the creek. The site will be divided into three precincts as shown in Figure 5 below.

The precincts are:

- Urban Quarter, higher-scale commercial activity and residential (apartments) precinct;
- Health Quarter, health and knowledge precinct (with commercial and residential uses);
- ~~Green Quarter~~, generally mid-rise residential (townhouses) with some apartments, commercial and service retail; and
- The proposed Habitat Corridor for the Growling Grass Frog (green hatching).

Refer to update #14

The final design of the development (and individual buildings with New Epping) will need to comply with the Development Plan (being prepared) however, the amount and manner of habitat clearing (i.e. development footprint), and impact on Matters of National Environmental Significance, will not vary from that outlined within the approved Preliminary Documentation (Ecology Australia 2018) and this document.

### 4.2.3 Habitat corridor

Refer to update #15

~~Prior to development of the Green Quarter, an 11-ha habitat corridor will be established to create and improve habitat for the site's Growling Grass Frog population.~~ The habitat corridor will traverse the site in a north-south orientation, incorporating existing features such as Edgars Creek and the main quarry waterbody (Figures 5, 6 and 7), and augmented by additional wetlands specifically designed to provide habitat for the Growling Grass Frog (see below). The proposed corridor is of varying width (c. 50 m at the narrowest point to c. 230 m across the quarry waterbody), with a buffer of approximately 20 to 40 m around constructed Growling Grass Frog wetlands (Figures 6 and 7). The terrestrial portion of the habitat corridor will be established and managed to provide high quality Growling Grass Frog foraging and dispersal habitat.

Refer to update #16


**Figure 5 ~~The precincts proposed for the redevelopment at 215, 315W and 325C Cooper St, Epping.~~**

### Habitat corridor design and population modelling

The preliminary design of the habitat corridor was based on the results of modelling undertaken to evaluate the likely occupancy by Growling Grass Frogs over time, following the proposed development (Ecology Australia 2016b). The model simulated the occupancy dynamics of the New Epping site Growling Grass Frog metapopulation, using a model developed by Heard *et al.* (2013, 2015). The model was a stochastic patch occupancy model, and enabled wetland occupancy by Growling Grass Frogs to be projected into the future and future metapopulation viability to be estimated. The model was built using a 11 years of monitoring data for Growling Grass Frogs from 190 sites in the Darebin, Merri and Moonee Ponds Creek catchments, entailing some 2,011 surveys between 2001 and 2012. Monitoring data from the Epping site were included in this dataset; hence, the model was directly applicable to the study area.

The model evaluated changes in wetlands occupancy, starting from the pattern of occupancy recorded by Wildlife Profiles (2015), over a 40-year timeframe. It assumed that created wetlands (at that time 7 permanent wetlands) would be 'best practice' and would align with the Melbourne Strategic Assessment draft guidelines available at the time (Biosis 2015).

The modelling results showed that the proposed habitat corridor concept, which at the time consisted of seven permanent wetlands to be created, occupancy would be the same or slightly higher over 40 years than under existing conditions (i.e. similar or slightly better outcomes over 40 years, under the assumptions tested). Importantly, an additional three 'managed ephemeral' wetlands have been added to the habitat corridor subsequently (see Section 7.4.5 and Figure 6).

### Legal protection of the habitat corridor

The proposed offset area (the habitat corridor) is located within larger properties at 215, 315W and 325C Cooper St, Epping. The property is owned by Riverlee, who will manage the property for the duration of this EMP and the OMP.

Further to the approach outlined in the Preliminary Documentation (section 4.3.5), it is proposed that offsets provided on-site will be secured through the zoning being applied Amendment C213 to the City of Whittlesea Planning Scheme through a combination of Urban Flood Zone, and Public Conservation and Resource Zones. Both zonings restrict development to minor works. ~~It is anticipated that the rezoning will occur by late 2019/early 2020.~~ Once the 10-year management period is completed (i.e. 10 years following completion of the Growling Grass Frog habitat corridor), the management of the creek corridor containing the direct offsets will become the responsibility of the public land manager (Melbourne Water and/or the City of Whittlesea) as is usual practice.

Refer to update #17

### 4.2.4 Staged development

Full development of New Epping will take 10+ years and development land will be released and built upon based on market dynamics. To minimise impacts to Growling Grass Frog, the new habitat corridor will be constructed first along with the Edgars Creek works. Development will then follow. The planned sequence is:

Refer to update #18

1. Pre-construction phase –establishment of the habitat corridor;
2. Construction phase – proposed development precincts (see Figure 5), being:

- Area 1 – Northern part of the Urban Quarter and Health Quarter; then
- Area 2 Green Quarter; then
- Area 3 – southern part of the Urban Quarter and Health Quarter.

3. Post-construction phase – maintenance and monitoring.

Refer to update #19

Development of the Growling Grass Frog habitat corridor will occur during the pre-construction phase; during this period, and for two breeding seasons following (~~i.e. October 2020 to April 2022),~~ no construction will occur in precincts that currently support Growling Grass Frog habitat (Green Quarter; Figure 5). In essence, the habitat corridor will be constructed first and then there will be a two-breeding season 'frog migration' period, which should enable Growling Grass Frogs to colonise newly created wetlands from existing areas of Growling Grass Frog habitat. For the precincts that do not support important Growling Grass Frog habitat (Areas 1,and 3 east of Edgars Creek; Figure 5), the construction phase may commence prior to or during the pre-construction period, but the order in which they will be developed is yet to be finalised.

The development is proposed to be staggered across the site, with designs, approvals and construction occurring on different timelines in some areas (Table 2).

Timing of the proposed redevelopment is contingent on the rezoning of the study area under Amendment C213 to the City of Whittlesea Planning Scheme, approval of the Development Plan and receiving a Planning Permit for works. t These applications will continue over the next six months, including finalisation of the environmental audits. ~~Should all approvals be resolved within this time, development of the Health Quarter (adjacent to the Cooper Street frontage) is planned to commence in early 2020~~.

Refer to update #20

The timing of the proposed redevelopment of Stage 2 (325C Cooper St in Figure 1) is uncertain as it is contingent on acquiring a land parcel from the State Government. 315W Cooper St was acquired by Riverlee in August 2019. 315W Cooper St was included in Stage 2 in the Preliminary Documentation, but is now included in Stage 1 given Riverlee control and certainty over delivery.

Stage 2 of development has been included in this EMP to show the impacts for the entire study area, however, it is requested that stage 2 (325C Cooper St) be conditioned separately to account for the uncertainty of Stage 2 occurring and that Stage 1 can be progressed independently of Stage 2 if the land comprising Stage 2 is not acquired by the proponent.

In the event that Stage 1 is approved but Stage 2 (325 Cooper St) does not proceed, the habitat corridor can still be constructed, including all proposed Growling Grass Frog wetlands (Sections 7.4.5 and 7.4.5)..

Refer to update #21

**Table 2 Indicative timing of activities associated with the pre-construction and construction phases of the New Epping redevelopment.**

Revegetation of the habitat corridor will commence during the construction period, but is likely to require ongoing maintenance (striped cells) until suitable habitat for Growling Grass Frogs has been established (i.e. frogs migrate into new wetlands and successful breeding occurs).

| Activity | Duration (months) | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|
| **Habitat Corridor (Pre-construction period, Growling Grass Frog area)** | | | | | | | | | |
| EPBC 'Action' Approval | 21 | | | | | | | | |
| Detail Design & Approvals | 21 | | | | | | | | |
| EMP and OMP Approvals | 6 | | | | | | | | |
| Tender and Award | 3 | | | | | | | | |
| Construction | 6 | | | | | | | | |
| Revegetation | ongoing | | | | | | | | |
| Frog Migration* | 20 | | | | | | | | |
| Adaptive Management* | 28 | | | | | | | | |
| **Area 1 – Urban Quarter, Health Quarter North (Construction period, non-Growling Grass Frog area)** | | | | | | | | | |
| Environmental Audit | 21 | | | | | | | | |
| Design and Approvals | 16 | | | | | | | | |
| Tender and award | 4 | | | | | | | | |
| Construction (Civil) | 12 | | | | | | | | |
| Construction (Built Form) | Ongoing | | | | | | | | |
| **Area 2 – Green Quarter (Construction period, Growling Grass Frog area)** | | | | | | | | | |
| Environmental Audit | 21 | | | | | | | | |
| Frog Migration* | 20 | | | | | | | | |
| Design and Approvals | 12 | | | | | | | | |
| Tender and Award | 4 | | | | | | | | |
| Construction (Bulk Earthworks)** | 12 | | | | | | | | |
| Construction (Civil)** | 12 | | | | | | | | |
| Construction (Built Form)** | Ongoing | | | | | | | | |
| **Area 3 – Urban Quarter, Health Quarter South (Construction period, non-Growling Grass Frog area)** | | | | | | | | | |
| Environmental Audit | 16 | | | | | | | | |
| Design and Approvals | 8 | | | | | | | | |
| Tender and Award | 4 | | | | | | | | |
| Construction (Bulk Earthworks) | 16 | | | | | | | | |
| Construction (Civil) | 12 | | | | | | | | |
| Construction (Built Form) | Ongoing | | | | | | | | |

* Adaptive Management will only occur if Growling Grass Frog do not successfully colonise constructed Growling Grass Frog wetlands.

** The timing of construction in the Green Quarter will be based on the successful migration of Growling Grass Frog to the habitat corridor. If frogs have not successfully colonised Growling Grass Frog wetlands, an additional adaptive management phase will occur. See Section 4.2.5 for further information.

### Remediation and rehabilitation of Edgars Creek

Edgars Creek will largely be cleared, remediated and revegetated for hydrological and ecological function, and to accommodate the proposed off-stream Growling Grass Frog wetlands as well as in-stream pools. One of the aims of the rehabilitation of the creek is to improve Growling Grass Frog habitat along the creek line for foraging, dispersal and potentially breeding, in addition to the off-stream wetlands to be created and the retained existing main quarry waterbody.

The remediation of Edgars Creek will include the creation of four in-stream pools in the southern end of the site, which will complement the off-stream wetland habitat and increase the variety of habitat types available to frogs at the site (Figure 6). Growling Grass Frogs are known to utilise areas of wider in-stream habitat in the Melbourne region, particularly well-vegetated pools, for foraging and potentially breeding (Pyke 2002).

In order to rehabilitate the creekline, the creek will need to be diverted into a temporary channel while works are completed in the creekbed. It is anticipated that this channel will be dug on the western side of the creek, and then filled in once the creekbed is remediated but prior to the construction of the off-channel wetlands.

The habitat corridor will be clearly delineated and fenced at the commencement of this phase, ensuring that only the works required to establish the habitat corridor occur in this area. This will include a temporary vehicle access track (c. 6 m wide) and stockpile areas (totalling c. 0.5 ha, Figure 9). Existing wetlands supporting the Growling Grass Frog, as well as surrounding terrestrial habitat between these wetlands, will be protected as 'no-go' zones during the development of the habitat corridor (with the exception of a single vehicle entry point), and for the migration phase and adaptive management phase (Figure 9 and Figure 12).

### Creation of wetland habitats

A number of habitat features will be created within the corridor to offset the habitat lost as a result of the development of the site, to supplement the retained quarry waterbody and the rehabilitated Edgars Creek, and increase the diversity of habitat available to the Growling Grass Frog population. Ten off-stream wetlands will be created to provide dedicated habitat for the Growling Grass Frog population (Figure 6 and Figure 7). The creation of wetlands will largely align with the Growling Grass Frog habitat design standards (DELWP 2017b; c) and will consider variables such as waterbody substrate, shape and depth, bank slope, hydroperiod and thermal properties to improve their suitability as Growling Grass Frog habitat (see Section 7.4.5 for details of created wetlands).

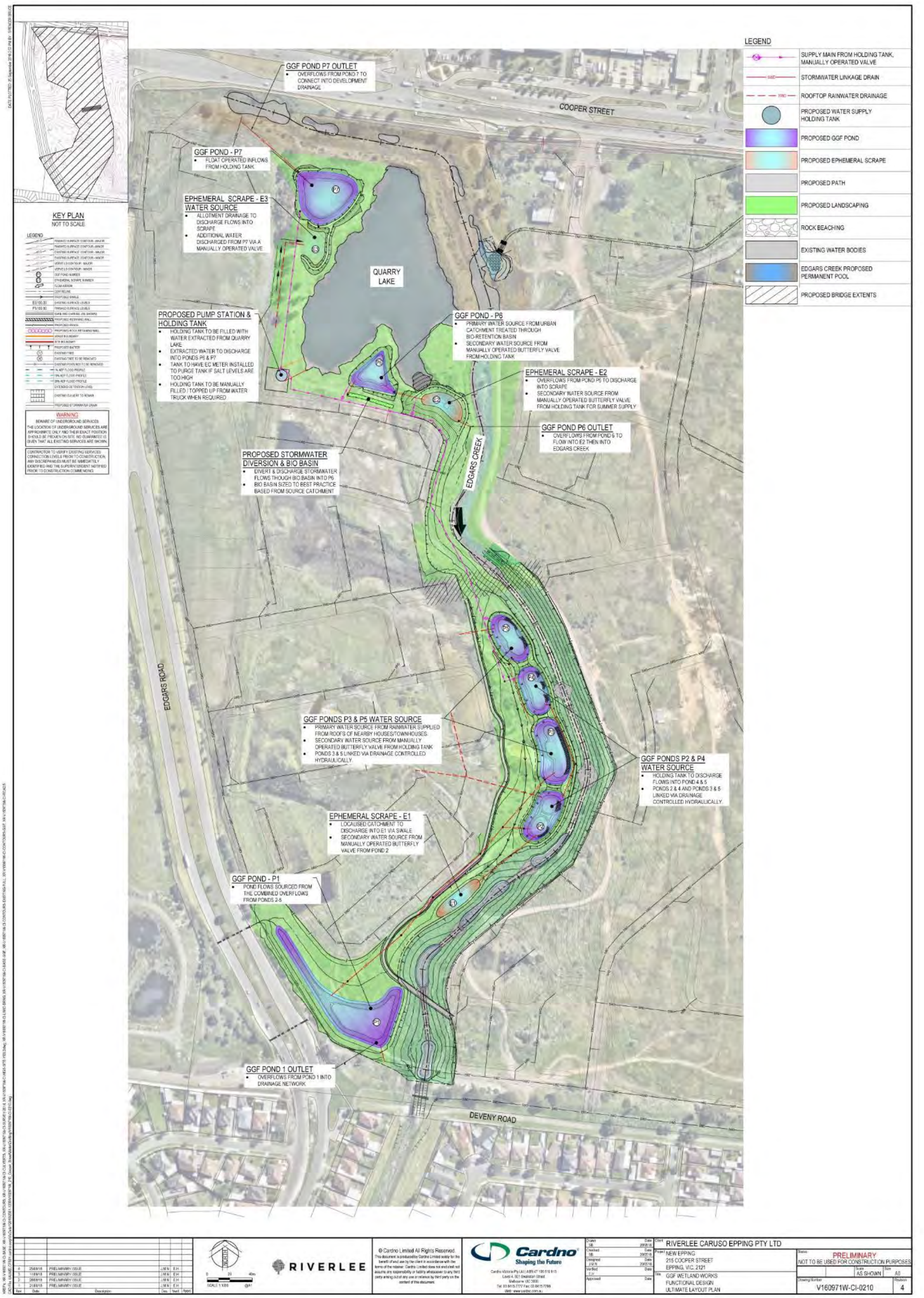



**Figure 6 Engineering design of the habitat corridor at the New Epping site, showing proposed wetlands, terrestrial habitat buffer and sections of the creek to be remediated.**

Refer to update #22

### Habitat corridor revegetation and enhancement

Revegetation of aquatic and terrestrial habitats along the habitat corridor will commence following realignment of the creek and construction of wetlands. Planted species will be diverse, indigenous to the area and drawn from a list of plants considered suitable for Growling Grass Frogs in the greater Melbourne region and for the on-site water quality conditions. Supplementary revegetation is likely to continue following this, to replace dead or damaged plants and to ensure habitat rapidly reaches suitability for Growling Grass Frogs migrating from existing on-site wetlands.

In addition to revegetation activities, enhancement of the fringing and terrestrial zone around constructed wetlands will occur. This will include the addition of surface rocks and logs; these are envisaged to be sourced largely from excavation and tree clearing activities undertaken at the site. Revegetation and enhancement works are described in more detail in Sections 7.4.5 and 7.4.6.

### Additional infrastructure

The habitat corridor will include shared paths to accommodate pedestrian activity in the redevelopment and to improve amenity. Shared paths will generally follow the boundaries of the habitat corridor (Figure 7 and Figure 8). Several small areas of public open space have also been proposed within and adjacent to the habitat corridor (Figure 7).

Frog fencing will be installed along the western side of the habitat corridor boundary to prevent the movement of Growling Grass Frogs into construction sites, and subsequently, roads. This fencing will not be constructed until migration into the habitat corridor from existing wetlands has occurred (see Section 7.4.14).

Refer to update #23

The abutments for the bridge over Edgars Creek will also be laid during the pre-construction phase. This will enable the bridge to be built during the construction phase with minimal disturbance to the habitat corridor, after its establishment (Section 7.4.14).

### Site improvement works

Site improvement activities will also occur in the pre-construction period, concurrent to development of the habitat corridor. Site improvement will consist of groundwater remediation in Area 3 (east of Edgars Creek) and potentially soil remediation in Areas 1 and 2. Investigation and input from consultants is underway to determine the extent of groundwater remediation and soil remediation work required. Any such work to be undertaken within the habitat corridor will be done simultaneously with the creation of wetland and terrestrial habitat; any such work to be undertaken west of the habitat corridor (i.e. Area 2B) will avoid 'no-go' areas (see Section 7.4.2).

## 4.2.5 Construction phase

Once all relevant permits have been received, the Construction phase will commence. Development of the Green Quarter must meet the following requirements before construction can commence:

Refer to update #24

- ~~A migration period lasting two full breeding seasons after the practical completion of Growling Grass Frog wetlands corresponding to the commencement of the prescribed maintenance period (i.e. not prior to mid-2022; Table 2).~~ If the construction and revegetation of the habitat corridor is delayed, the construction of the Green Quarter must be postponed to allow for this designated migration period of two full breeding seasons;

Refer to update #25


**~~Figure 7~~ Indicative landscape plan of the proposed habitat corridor at the New Epping site, Victoria (Tract Consultants)**

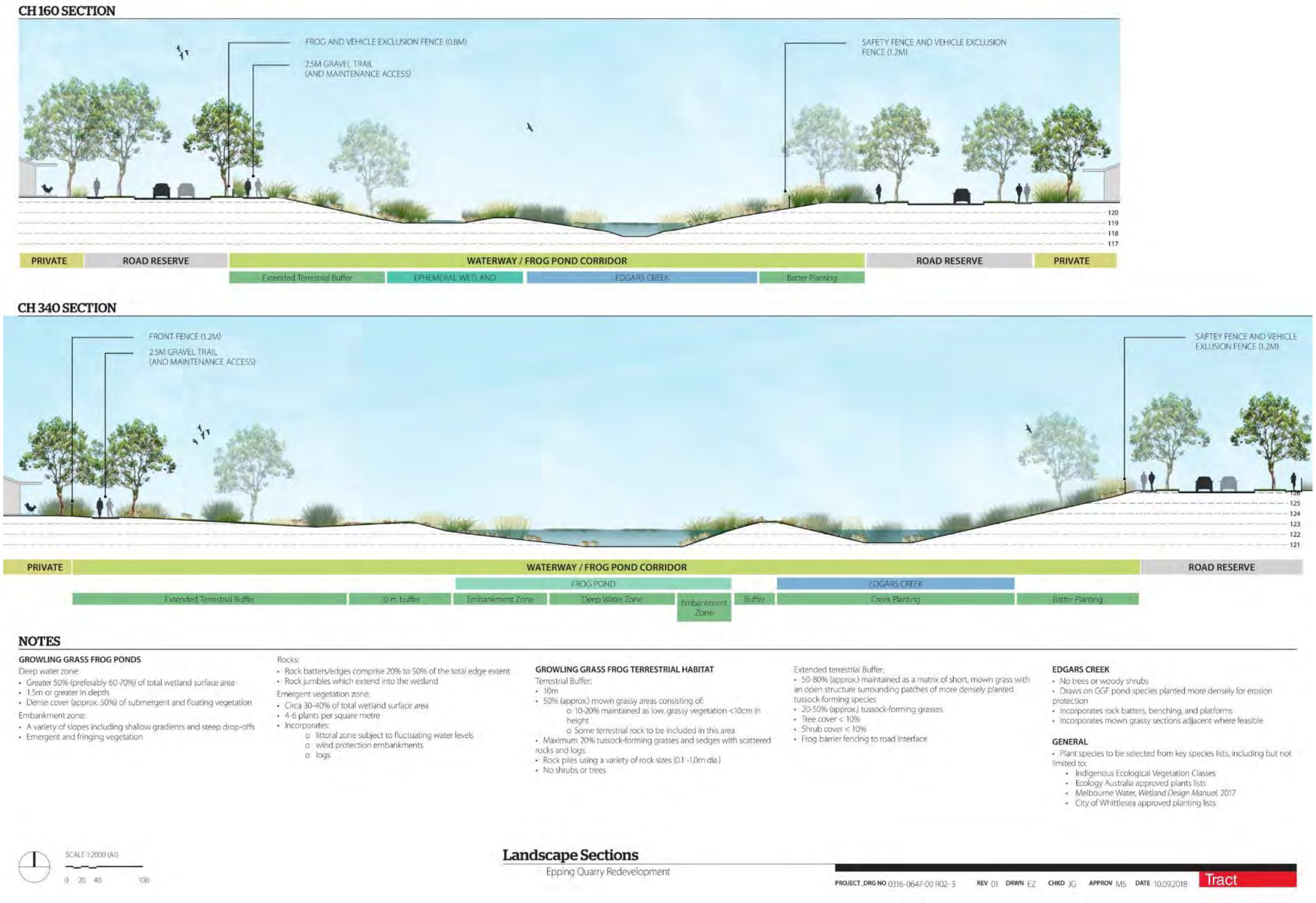



**Figure 8 Indicative cross sections of the proposed habitat corridor. The locations of these cross sections are shown in Figure 7 in red (Tract Consultants)**

- Growling Grass Frogs are recorded in 50% (4 or more) of the permanent, constructed off-stream wetlands.
- Successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season; these criteria are informed by the assumptions of modelling occupancy at the site (Ecology Australia 2016a), as well as through successful breeding having been recorded in two or more of the existing wetlands in both previous surveys (Wildlife Profiles 2015, Ecology Australia 2017a), including the large existing wetlands #2 and #3. If successful breeding in at least two created wetlands is not demonstrated during the two year 'frog migration' period (i.e. during annual Growling Grass Frog monitoring), an additional year of 'adaptive management' will be initiated (see Section 6.4.8).

If the requirements outlined above are met, construction can commence in Area 2A (i.e. within the no-go zones). Areas of habitat to be protected and movement corridors (i.e. no-go zones) for the species are given in Section 7.4.2

The construction phase will consist of numerous tasks such as bulk earthworks, road construction (including access roads, walkways, intersections and parking lots), bridge construction, landscaping, service connections to municipal services and public utilities, drainage, the installation of external lighting and building construction. Areas for material stockpiling, vehicle access and parking during construction will be confined to selected areas outside of the Growling Grass Frog habitat ~~corridor and the no-go zones in the Green Quarter.~~

Refer to update #26

During the ~~construction phase,~~ the grassy stormwater drain in the north east of the site will be piped and enter Edgars Creek at the northern in-stream wetland (wetland 12).

Refer to update #27

### 4.2.6 Post-construction phase: Maintenance and monitoring

Following the removal of existing Growling Grass Frog habitat outside the habitat corridor, there will be ongoing maintenance and monitoring. These will be covered in more detail in the Onsite Offset Management Plan (OMP) (Ecology Australia 2019b).

Refer to update #28

#### Habitat corridor maintenance

The Growling Grass Frog habitat corridor will require regular maintenance to ensure terrestrial and aquatic habitats remain suitable. Permanent and ephemeral wetlands will require different hydrological regimes, which will require active management. Ephemeral wetlands will need to be allowed to dry annually over winter and permanent wetlands may occasionally require draining to remove exotic fish such as Eastern Gambusia.

The habitat corridor will require ongoing revegetation to replace dead plants, weed control and mowing to maintain a mixture of dense, tussock grasses and areas of low, grassy vegetation and bare ground. Within 10 m of created/retained wetlands (the '10 m buffer'), mowing will be limited in frequency to reduce the risk of mortality to Growling Grass Frogs.

#### Annual Growling Grass Frog monitoring

Annual monitoring of the Growling Grass Frog population in the study area will be required during the development of the habitat corridor for the 10 year management period. Monitoring will assess

occupancy, colonisation, abundance, breeding and habitat quality of new wetlands and abundances at existing wetlands during migration phase. Monitoring will determine the need for adaptive management during the migration phase, the construction phase and/or post construction phases. Monitoring of the existing and new wetlands will aim to detect successful breeding and any changes to the distribution and abundance of the frog population, in addition to assessing the suitability of revegetated habitat and water quality.

Refer to update #29

~~There will be two surveys of Growling Grass Frogs per breeding season (generally October to March), and will align with the EPBC Act survey guidelines (DEWHA 2009a).~~ Further details regarding monitoring are provided in Sections 7.4.17 and 10.

# 5 Potential impacts of the development

The principal potential impacts of the New Epping development on threatened species are the loss of habitat, a reduction in habitat quality, an inability to create suitable habitat in the habitat corridor, direct mortality of individuals, increased prevalence of disease and invasive species and reduced regional population connectivity. These impacts relate primarily to the Growling Grass Frog.

## 5.1 Potential impacts on Growling Grass Frog

The results of Growling Grass Frog surveys in 2014/15 (Wildlife Profiles 2015) suggested that the long term viability of the Growling Grass Frog population at the proposed redevelopment site was uncertain, based on low apparent recruitment and the current conditions and management of the site. However, subsequent surveys undertaken in 2016/17 (Ecology Australia 2017a) under more favourable conditions, namely increased rainfall during spring and early summer, recorded a greater abundance of frogs and increased breeding success at the site. Likewise, surveys undertaken in 2018-2019 recorded a similar number of Growling Grass Frog to the 2016/17 surveys (Ecology Australia, In Prep.)

Potential impacts to the Growling Grass Frog resulting from the proposed redevelopment encompass the following:

- Reduction in area of breeding, foraging and refuge habitat;
- Changes in habitat quality, including changes to hydrology and contaminant levels;
- Impacts on individuals, including direct mortality, disease, and anthropogenic disturbance;
- Population-level impacts influencing persistence of the local population; and
- Regional impacts to the Edgars Creek metapopulation.

These impacts are discussed in further detail below.

### 5.1.1 Reduction in area of habitat

Existing Growling Grass Frog habitat at the site which will be impacted by the proposal consists of the following:

- Off-stream wetlands;
- Waterways, comprising a portion of Edgars Creek and an associated drain; and
- Terrestrial habitat surrounding wetlands and waterways.

The area of each habitat type is outlined in Table 3.

#### Existing off-stream wetlands

The proposed redevelopment will result in the removal of 9 of the existing 10 off-stream wetlands on the site, covering approximately 2.00 ha. These wetlands are proposed to be removed following the creation of 10 newly constructed wetlands (Figures 2 and 6), which will cover approximately 1.14 ha (see Section 7.4.5). Therefore, the creation of wetland habitat and the subsequent removal of the 9 existing wetlands results in a deficit of approximately 0.86 ha in the overall area of off-stream wetland habitat. However, several of the existing wetlands covering approximately 0.27 ha (e.g. waterbodies 5, 6, 7, and 10, Figure 2) appear to provide limited or no suitable habitat for the Growling Grass Frog, while several

other wetlands (e.g. 8 and 9, 0.43 ha) are ephemeral and appear to only support breeding habitat in years of above average rainfall (Wildlife Profiles 2015; Ecology Australia 2017a, Ecology Australia In Prep.). Created wetlands will be designed and managed to maintain suitable breeding habitat for this species (see Section 7.4.5). Therefore while the overall area of wetland habitat created will be less than under existing conditions, the proposed habitat corridor is likely to provide a similar or greater amount of high quality potential breeding habitat in most years.

Existing waterbodies 2 and 3 appear to provide the bulk of potential breeding habitat (Wildlife Profiles 2015; Ecology Australia 2017a, Ecology Australia In Prep.); these wetlands combined make up approximately 0.92 ha. Removal of these wetlands, in the absence of effective mitigation, would likely have a major negative impact on the viability of the Growling Grass Frog metapopulation.

**~~Table 3 Initial areas of each habitat type, and habitat areas lost, retained and constructed and the net gain/loss of each habitat type. Areas are in hectares.~~**

Refer to update #30

| Habitat type | Initial area | Area lost | Area retained | Area constructed | Final Area | Net loss/gain |
|---|---|---|---|---|---|---|
| Off channel wetland | 3.52 | 2.00 | 1.52 | 1.14 | 2.66 | -0.86 |
| In stream wetlands | 0.51 | 0.02 | 0.49 | 0.18 | 0.67 | +0.16 |
| Riparian (30 m from wetlands) | 7.42 | 6.28 | 1.14 | 3.17 | 4.31 | -3.11 |
| Terrestrial – suitable for Growling Grass Frogs | 9.13 | 9.13 | 0 | 3.8 | 3.8 | -5.33 |
| Terrestrial unsuitable for Growling Grass Frogs | 30.60* | 30.60 | 0 | 0 | 0 | -30.6 |
| Total | 51.18 | 48.03 | 3.15 | 9.68 | 11.44 | -39.74 |

*includes 25.18 ha of unsuitable Growling Grass Frog habitat and 5.42 ha of GSM habitat.

### Waterways

Waterways within the site consist of Edgars Creek, which traverses the site in approximately a north-south direction, and an associated drain which flows into Edgars Creek from the northeast of the site. The majority of Edgars Creek will be remediated, however the northern portion of Edgars Creek (approximately a quarter of its length within the site) will not require remediation works, as creek rehabilitation and revegetation works were already undertaken in this section by Melbourne Water in 2009 and 2010. The majority of the southern three quarters of Edgars Creek, from the southern extent of the Melbourne Water remediation works to the southern boundary of the site, will be subject to remediation works to achieve required water management objectives for the site and to improve its ecological function (see Section 7.4.3). This section of the creekline currently includes one small in-stream wetland of approximately 0.02 ha (wetland 11, Figure 2), which is proposed to be removed. As part of the proposed works, a series of in-stream wetlands will be developed in this area, covering a total of approximately 0.18 ha (Figure 6 and Figure 7; see Section 7.4.3).

The existing open stormwater drain in the northeast of Stage 1 is proposed to be piped, between Cooper Street and Edgars Creek, as a continuation of the existing upstream piped system. The ephemeral drain proposed to be removed is approximately 300 m long and densely vegetated; it is not

considered to provide breeding habitat, however, it may provide foraging habitat, and facilitate movement to a small ephemeral wetland in the northeast of the site, which is also proposed to be removed. Drainage beyond this point (i.e. upstream) is piped underground and does not provide connectivity for Growling Grass Frog through the surrounding landscape. A formed swale will be constructed along the northern boundary of the site between Edgars Creek and the hospital to capture surface water flows during high rainfall events.

Wetland 12 (Figure 2) will be modified slightly to accommodate the outlet of the newly piped drain in the north-east of the site. These works will involve extending the wetland to the north-east to accommodate a velocity control pond at the outlet of the drain, rock beaching to control erosion and regrading the exit of the current open drain. The new outlet will be a marked improvement from the existing drain, as will it discharge more in line with Edgars Creek flow path. The majority of the remainder of the northern half of the creekline itself will also remain undisturbed but riparian habitat in this section will be subject to remediation and revegetation work.

The net change to the area of in-stream habitat under the proposed development will be positive. While the existing open drain in the north-east of the site and a small in-stream pool (Wetland 11; Figure 2) will be removed, there will be an small increase (0.16 ha) in the amount of in-stream pool habitat following remediation works (Table 3).

### Riparian habitat

Growling Grass Frogs use riparian zones for foraging, basking, movement, calling, shelter and overwintering. It is likely that the majority of terrestrial habitat use by Growling Grass Frogs occurs in close proximity to wetland habitat (Wassens et al. 2008, Heard et al. 2012). The proposed development includes the removal of approximately 6.28 ha of riparian habitat (defined here as habitat within 30 m of off-stream wetlands). The riparian zone around the proposed constructed wetland covers approximately 3.17 ha. While this represents a decline of 3.11 ha of riparian habitat, the new riparian habitat will be constructed, revegetated and managed to specifically meet the needs of Growling Grass Frog (see sections 7.4.5 and 7.4.6), so will be far higher quality than the current riparian habitats on site.

We consider that a 30-metre riparian habitat zone surrounding each waterbody would incorporate the important microhabitats available to GGF at the project site. Supporting evidence includes:

- the vast majority of GGF records being within 20 m of waterbodies documented during the 2016-2017 survey (Ecology Australia 2017a);
- the relative abundance of microhabitats closely proximate to the waterbodies, and their scarcity elsewhere; and
- the importance of microhabitats in the riparian and aquatic zones of wetlands in the Merri and Edgars Creek catchments described by Heard *et al.* (2004).

If unmitigated, the loss of 6.28 ha of riparian habitat at the site (i.e. without the proposed habitat corridor) would be likely to materially contribute to and hasten the potential extirpation of the local Growling Grass Frog population.

### Terrestrial habitat

Terrestrial habitat for GGF is defined as potential foraging and movement terrestrial habitat, excluding the 30 m riparian buffer zone.

~~The proposed development includes the removal of 9.13 ha of terrestrial habitat, allowing for metapopulation movement between existing waterbodies.~~

Refer to update #31

While Growling Grass Frog is considered a highly mobile species (Robertson *et al.* 2002), particularly in relation to dispersal and/or movement between waterbodies, the evidence from the project site and surrounding catchments (Edgars and Merri Creeks) suggests that the majority of activity is closely proximate to the waterbody (Heard *et al.* 2004; Wildlife Profiles 2015; Ecology Australia 2017a). That is, the favoured microsites documented by Heard *et al.* 2004, including: bare soil, bank-side rock leaf litter, ground vegetation, emergent (aquatic) vegetation, floating and submergent vegetation and emergent rock, are mostly located within or close to the waterbodies. Further, we are aware of no studies that examine the utility of GGF habitat at increasing distance from waterbodies, other than reference to long distance movements associated with dispersal or other metapopulation movements.

At the project site, factors limiting the utility of dryland habitat removed from the wetland environs include the rank growth of weeds, the lack of suitable microhabitats, and the very limited opportunities for effective dispersal to other offsite GGF habitats.

Dispersal to areas outside the project area is strictly limited, with individuals having to either negotiate major roads or urban areas in search of habitat or utilise lengthy creek culverts under Edgars Road and Cooper Street, which on all the available evidence is highly problematic. In this context the occupancy model (Heard *et al.* 2013, 2015) applied to existing conditions versus the proposed habitat corridor considered the project area as effectively isolated (Ecology Australia 2016b).

~~Approximately 5.18 ha of terrestrial habitat are proposed to be constructed within the habitat corridor~~ (i.e. excluding retained and to be constructed wetlands); this habitat will be subject to remediation, revegetation and amenity-related works during the construction of the habitat corridor. ~~Hence, there is effectively a loss of approximately 3.95 ha of terrestrial habitat (Table 3).~~

Refer to update #32

Refer to update #33

There is material uncertainty regarding effective terrestrial buffer distances for the Growling Grass Frog under various scenarios. The Significant Impact Guidelines for the Growling Grass Frog (DEWHA 2009b) suggests the retention of buffer zones of at least 200 m around waterbodies in temperate regions. In an assessment of metapopulation viability of the species in Melbourne's growth areas, Heard and McCarthy (2012) modelled different habitat corridor widths (where wetland area is lost as width is reduced) and wetland creation scenarios. They found that "riparian habitat corridors of ≤ 200 m in width (≤ 100 m either side of streams) entail significant increases in the risks of quasi-extinction for metapopulations of *L. raniformis*" (Heard and McCarthy 2012, p32). However, they also found that the creation of wetland habitat could significantly or fully offset the increase in probability of quasi-extinction. The number of wetlands required was dependent on location and reduction in corridor width; however, on average the creation of six or more wetlands was required to offset the loss of surrounding terrestrial habitat at largely undeveloped sites down to buffers 400 m or 200 m (Heard and McCarthy 2012). It is important to note that these findings primarily reflect the distribution of existing wetlands within the habitat corridors; in a scenario where most of the wetland habitat existed in close proximity to the creekline, the impacts of decreasing corridor width would presumably be substantially reduced.

While the above suggest that a relatively wide terrestrial buffer is beneficial for the species, data from surveys in the greater Melbourne region suggest that Growling Grass Frog metapopulations can persist, at least in the medium term, in the absence of sizeable terrestrial buffers. At Village Park in Caroline

Springs, Victoria, a series of sediment ponds and treatment wetlands were constructed in the early 2000s. The 'buffer' (i.e. area of terrestrial and riparian vegetation) between ponds and surrounding developed land, primarily residential, generally ranges from approximately 10 to 30 m. Surveys in the 2014/15 and 2015/16 seasons showed that seven of the 17 ponds were occupied by Growling Grass Frog, with up to 50 individuals observed at a pond and successful breeding recorded (Ecology Australia 2017b). There are numerous historical records from this wetland cluster, particularly between 2004 and 2007 (DELWP 2017a), suggesting that a Growling Grass Frog metapopulation has persisted since at least 2004. The average vegetated buffer around occupied wetlands is less than 20 m. From available aerial imagery, the wetland complex appears to have had its current level of development since around 2004. Given the above, and that there is very little apparent connectivity through the landscape, it seems likely that this Growling Grass Frog metapopulation has persisted and apparently maintained metapopulation function in this wetland cluster for at least 13 years, with small terrestrial buffers.

This finding is supported by the results of longitudinal monitoring of the Growling Grass Frog metapopulation at the Western Treatment Plant in Melbourne (e.g. Ecology Australia 2016c). This site represents one of the largest known Growling Grass Frog populations in Victoria, and consists of numerous small to large operational and non-operational wetlands. The majority of the occupied wetlands have expansive areas of wetland surrounding them, often with a limited amount of vegetated terrestrial habitat in proximity; supporting the view that the amount and quality of aquatic habitat is generally more important for this species than the amount or quality of terrestrial habitat per se.

Taken together, the above lines of evidence suggest that where other factors are equal, increasing terrestrial buffer widths is likely to be beneficial for Growling Grass Frog metapopulations. However, the magnitude of the benefit likely decreases with distance; furthermore, sizeable terrestrial buffers do not appear to be essential for metapopulation persistence in some scenarios where numerous suitable wetlands occur in proximity.

If unmitigated, the loss of the entire 39.7 ha of terrestrial habitat at the site (i.e. without the proposed habitat corridor) would be likely to materially contribute to and hasten the potential extirpation of the Growling Grass Frog metapopulation.

### 5.1.2 Changes in habitat quality

The majority of potential impacts from the proposed development relate to habitat removal. Of habitat to be retained, i.e. within the habitat corridor, works will be limited to those necessary for habitat creation and enhancement, drainage requirements, and proposed infrastructure (e.g. the road crossing, shared pathways and several small public use areas).

Potential impacts to habitat quality from the proposed development are discussed below.

#### Hydrology

To achieve required water management objectives for the site, the majority of Edgars Creek, from the wetland 12 to the southern boundary of the site, will be remediated.

Water flows through Edgars Creek will increase over time due to increasing urbanisation of the catchment area from this proposed development and others. The precise impacts of increased flows are uncertain; however, if they increase the permanence of in-stream pools throughout the Growling Grass Frog breeding season, increased flows are likely to have a generally positive effect on Growling

Grass Frogs (Hamer *et al.* 2016). Conversely, increased velocity of flows are likely to have a negative impact on Growling Grass Frogs where hydroperiod is not a limiting factor (e.g. permanent/semi-permanent waterways) and increased flows may impact aquatic vegetation structure and/or extent, and breeding success may be reduced due to scouring of egg deposition sites and washing of tadpoles downstream. However, given that successful breeding within Edgars Creek at the site is currently considered unlikely (Wildlife Profiles 2015; Ecology Australia 2017a), potential increased velocity of flows is unlikely to decrease breeding success at in-stream wetlands. In-stream pools along Edgars Creek will increase in number and area under the proposed action; this will increase the likelihood of breeding success within the waterway under favourable conditions.

Conversely, increased stream flows and levels could negatively impact nearby off-stream wetlands, particularly where they occur within the flood zone. Overtopping into off-stream wetlands can introduce exotic fish, such as Eastern Gambusia, and potentially reduce water quality. Given that all existing wetlands except for the quarry are proposed to be removed, this is expected to be a potential issue for created wetlands, and is discussed further in Section 7.4.5. However, all constructed wetlands will be constructed over the 1 in 10 ARI (Average Recurrence Interval). Constructed wetlands will also be designed so they can be drained if Eastern Gambusia become established. We note that overtopping into the quarry currently occurs periodically and, according to the on-site land manager, occurred during the 2016/17 survey season; prior to this the quarry already supported a large population of Eastern Gambusia (Wildlife Profiles 2015).

### Wetland diversity/structure

Currently, the Growling Grass Frog metapopulation appears to utilise a variety of permanent and ephemeral wetlands at the New Epping site. Wetlands 2 and 3, where the bulk of both adult frogs and successful breeding were recorded, provide a variety of habitat features and conditions within them, including deep areas that appear to retain water in most years as well as expansive drawdown areas with a range of rocky substrates and extensive aquatic vegetation (fringing, emergent and submergent). The removal of these wetlands may reduce the diversity of wetlands habitats available to Growling Grass Frogs if new similar habitats are not created.

### Contaminants

Water quality at the site is currently impacted by the former use as landfill. Leachate appears to be occurring in groundwater at the site (Edge Group 2019) . Groundwater monitoring by Edge Group (2019) showed that the main quarry waterbody is cross gradient of the landfill cell and is unaffected by direct landfill leachate. However, the quarry waterbodies are likely to be receiving groundwater contribution given the base of these features is several metres below the nearby groundwater standing water level. Groundwater mounding observed at the site, a result of leachate in the landfill cell, and northerly radial flow are concluded to have contributed to quarry waterbody quality as the regional south-westerly flow captures any impacts in groundwater, resulting in leachate contaminants migrating to the west (i.e. into quarry waterbodies). The contaminants identified in the quarry waterbodies and Edgars Creek include ammonia, heavy metals (boron, copper, nickel and zinc) and per- and poly-fluorinated alkyl substances (PFAS).

High concentrations of leachate contaminants are generally not present in the quarry waterbodies indicating gross contamination of these water bodies has not occurred. The risk of groundwater impacts to the main quarry water body is characterised as low and acceptable. This conclusion was based on an

Ecological Risk Assessment (ERA) (ToxConsult 2019) with consideration made to potential future changes in groundwater elevation.

Increased urbanisation in the Edgars Creek catchment as a result of the New Epping development and other developments in the catchment are likely to reduce water quality and increase the concentrations of contaminants in the catchment. This regional impact is acknowledged in the State Environment Protection Policy (Waters) (EPA Victoria 2018) with regards to urban water bodies.

It is important to note that elevated heavy metals or other contaminants do not necessarily impact frogs generally, or the Growling Grass Frog specifically. Evidence in this area is limited and equivocal in some regards. Ficken and Byrne (2013) showed that frog species richness in the region, including Growling Grass Frogs, was negatively associated with sediment concentrations of six heavy metals: copper, nickel, lead, zinc, cadmium and mercury, as well as with orthophosphate. Conversely, a study on the North American Gray Treefrog (*Hyla chrysoscelis*) showed that the presence of elevated levels of copper mitigated the effects of chytrid fungus on larval development (Parris and Baud 2004). Preliminary findings from an analysis of contaminant data and frog communities at a small number of sites (n=14-17 depending on contaminant type) in the greater Melbourne area suggest that pesticides (synthetic pyrethroids, diuron) may be of greater concern, at the levels tested, than heavy metals or hydrocarbons (Ecology Australia, in prep.).

Given these findings it is plausible that elevated levels of some contaminants may negatively impact Growling Grass Frog, while other contaminants may have no discernible impact or could even be beneficial by reducing incidence of chytrid. The concentration at which contaminants may affect frog species is currently poorly known and varies between species (ToxConsult 2019). As a result, an ERA was undertaken by ToxConsult (2019) to further understand the risk posed by Site-sourced contamination on the Growling Grass Frog population within surface water receptors at the site. The ERA dealt with the potential adverse effect to Growling Grass Frog population by assessing the impact for harm by substances currently in the surface water where the Growling Grass Frog are, and in leachate within the waste. The ERA concluded there are currently no unacceptable risks to the quarry waterbodies and Edgars Creek from leachate contaminated groundwater (ToxConsult 2019). It should be further noted that the results of recent surveys suggests that contaminant levels in some of the wetlands (2 and 3 particularly) are not currently precluding successful Growling Grass Frog breeding (Ecology Australia 2017a).

Potential impacts from elevated levels of contaminants are largely an artefact of the previous use of the eastern portion of the site as a landfill; the proposed action will not increase these impacts, and the proposed management of soil and groundwater, as well as the design and maintenance of created wetlands, is unlikely to increase the levels of a number of currently elevated contaminants. Mitigation of habitat quality impacts are described in Section 7.4.5, including potential changes in habitat quality between wetlands proposed to be removed and those to be created.

We note that groundwater is the current water source for most large existing wetlands, and will also be utilised extensively for created wetlands. Hence, water quality within constructed wetlands is expected to be broadly similar to existing conditions.

### Shading

Where wetlands are located proximate to trees or buildings, overshading of wetlands poses a material risk to the maintenance of habitat quality for the Growling Grass Frog (Heard *et al.* 2014). Shading potentially impacts on the Growling Grass Frog through the following mechanisms:

- Increasing the prevalence and/or intensity of chytrid infection by reducing water temperature and potentially basking opportunities;
- Reduced fitness of adult frogs and tadpoles (e.g. increased tadpole development times) by reducing water temperature and basking opportunities;
- Reducing wetland productivity by reducing water temperature and insolation; and
- Impacting growth of aquatic and fringing vegetation through reduced sunlight (Heard *et al.* 2014).

Recent surveys across 131 constructed wetlands in greater Melbourne showed that tree cover within 10 m of wetlands had a significant negative effect on Growling Grass Frog abundance; with other factors being equal, the ideal amount of shading was effectively zero (Ecology Australia 2017b).

Depending upon the height and form of surrounding buildings, overshading from buildings (and trees) could have a negative impact on the quality and suitability of wetland habitat (both existing and proposed to be created). Given the importance of reducing shading of Growling Grass Frog wetlands, a number of measures have been proposed to mitigate the potential impacts of shading (see Section 7.4.14).

### 5.1.3 Impacts on individuals

Potential impacts to individuals are considered to consist of the following:

- Mortality (direct and indirect);
- Disease (i.e. chytridiomycosis); and
- Disturbance-related impacts.

### Mortality

Mortality of resident frogs is a potential consequence of on-site construction works during the construction of the habitat corridor and removal of existing habitat.

During the construction of the habitat corridor, there is a risk that construction vehicles and heavy machinery used during removal of vegetation and earthworks within the habitat corridor may kill Growling Grass Frogs. Frog mortality during this phase will be reduced by establishing no-go zones around existing Growling Grass Frog habitat (Section 7.4.2) and with pre-clearance searches for Growling Grass Frogs (sections 7.4.3 and 7.4.5).

The greatest risk of frog mortality exists in relation to the removal of existing wetlands (approximately 1.98 ha), plus fringing terrestrial vegetation in which Growling Grass Frogs may be sheltering. The two year-long frog migration phase (section 7.4.1and 7.4.8)and pre-clearance searches and salvage prior to and during earthworks are proposed to mitigate the risk of mortality during construction works (sections 7.4.8, 7.4.9, 7.4.11 and 7.4.16).

The proposed construction of several roads within the project area also poses an increased risk of frog mortality; fencing to restrict frog movement onto roads is a key mitigation strategy (see section 6.4.11).

Direct predation from exotic/domestic animals may also increase as a result of the proposed action; however, there is little data on the extent of such predation in rural or urban areas. Populations of invasive fish exist in Edgar's Creek and at the main quarry pit (waterbody 1), these are currently unmanaged so it is likely that in the proposed, properly managed system the impacts of invasive fishes will be reduced. We note that frogs generally make up a very small proportion of the diet of foxes and cats (Jones and Coman 1981; Catling 1988) and such predation is therefore unlikely to be a driver of frog population dynamics in most scenarios. Invasive species control is outlined in section 7.4.12.

Mortality may also arise from indirect means, such as the introduction/spread of chytrid fungus (see below) or temporary removal, reduction in the availability of food and shelter or failed migration to and establishment in the new habitats.

The mortality of frogs is likely to be substantially reduced by the proposed management actions; however, the mortality of some individuals remains likely under the proposed redevelopment, especially during the removal of existing habitat.

### Chytrid fungus

The chytrid fungus *Batrachochytrium dendrobatidis* is a virulent, water-borne pathogen that infects amphibians, causing chytridiomycosis. One of the most severe diseases of wild amphibians, chytridiomycosis affects the keratinised epidermal cells (Heard *et al.* 2014); it is thought that the fungus inhibits the skin's osmoregulatory function, leading to morbidity and death. Chytrid fungus has been implicated in the rapid decline or extinction of up to 200 frog species worldwide (Skerratt *et al.* 2007). In Australia, chytridiomycosis is one of the most common diseases of amphibians (Berger *et al.* 1999) and is implicated in the extinction of at least four species of frog and in the decline of at least ten other species (Berger *et al.* 1998; DoEE 2016). Infection of amphibians with chytrid fungus resulting in chytridiomycosis is listed as a key threatening process under the EPBC Act, and a threat abatement plan was revised in 2016 (DoEE 2016).

Wild amphibians are at risk of exposure to the chytrid fungus via contact with the environment, i.e. water and moist substrates, and with other amphibians. Resistance to the disease varies among amphibian species, as well as within species. The disease has caused 100% mortality in some species at low chytrid loads (Berger 2001), but some species appear to be resistant and can persist as carriers (Skerratt *et al.* 2007). Chytridiomycosis may also be influenced by environmental factors; the growth of chytrid fungus is inhibited at high temperatures (above 26–28°C), in saline conditions (Stockwell *et al.* 2015) or outside its ideal pH range (c. 6–7) (Piotrowski *et al.* 2004; Stevenson *et al.* 2013). In studies of frog populations where infection is endemic, chytrid is more prevalent and/or infection loads are higher in cooler, wetter conditions, including at higher altitudes (McDonald *et al.* 2005) and during winter and spring (Retallick *et al.* 2004).

The chytrid fungus has been found in all states and territories (except the Northern Territory) and in a wide range of climates and habitats, at both high and low altitudes (Berger *et al.* 1999; Murray *et al.* 2010); it is likely ubiquitous in the Melbourne region. While chytrid sampling hasn't been undertaken at the site, it is likely widespread in wetlands and waterways in and surrounding the site.

Mechanisms that could potentially increase the spread or impacts of chytrid fungus on the Growling Grass Frog population at the site include the following:

- Changes in habitat quality that increase the prevalence or infection load of the disease, particularly a reduction in the temperature and/or salinity of water (section 7.4.5 and 7.4.6).
- Introduction of machinery, vegetative material and other substances contaminated with chytrid from outside the site (section 7.4.13).
- Survey, capture and translocation associated with the proposed action could potentially spread chytrid spores (where hygiene protocols are not strictly followed; see Section 7.4.16).

### Disruption of movement patterns

The proposed development will alter the existing spatial configuration of the site and involve the construction of tracks and other infrastructure that may alter dispersal capacity and patterns.

Refer to update #34

During the pre-construction phase while the habitat corridor is being constructed, movement from the existing wetlands to Edgars Creek may be restricted. A haul road (~~approximately 6 m wide~~) will be constructed alongside Edgars Creek to give construction vehicles access to the habitat corridor. The haul road will have two entry points, one to the south of existing wetlands, and another running between wetlands 8 and 9 (Figure 9). The latter has the capacity to disrupt movement to the south of wetland 8; however this area is not high quality Growling Grass Frog habitat and in addition the access track is narrow and unlikely to create a major barrier to movement. Three stockpile areas (~~totalling 0.5 ha in size~~) will also be required along the haul road (figure 9). Finally earthworks for realigning Edgar's Creek and constructing new wetlands will create large areas of disturbance until revegetation works occur. The current movement patterns of Growling Grass Frogs between breeding, sheltering or foraging habitats within this area are unknown; however, the nature and scale of the proposed works are not expected to create major physical barriers to the movement of Growling Grass Frogs. While the stockpiles and earthworks may create minor barriers to movement, these are outside the core Growling Grass Frog habitat (wetlands 1, 2 and 3) and are thus unlikely to have a major impact on Growling Grass Frog dispersal.

During the frog migration phase, haul roads and stockpiles will be removed and vehicle access prohibited, and it is anticipated that Growling Grass Frogs will move from existing wetlands to newly constructed wetlands. During this time, the habitat corridor and areas of existing habitat will be designated as no-go zones. Vehicle access and stockpile areas used during the establishment of the habitat corridor will no longer be used, thus frog movement patters are unlikely to be altered.

Following completion of the habitat corridor and the two year migration period, a bridge will be constructed over Edgars Creek, crossing the habitat corridor, to provide a connection to Edgars Road. The footings/abutments for bridge will be constructed during the development of the habitat corridor (avoiding existing wetland #3) minimising disturbance during its subsequent construction. The section of road on the western side of Edgars Creek will include a frog passage option (e.g. culvert design amenable to Growling Grass Frog passage (DELWP 2017c)) to minimise structural barriers within the terrestrial habitat.

Existing connections to habitat north, south and southwest of the New Epping development will be maintained, however it is unclear whether existing connections under Edgars Road, Deveny Road and Cooper Street are utilised by Growling Grass Frogs.

### Disturbance-related impacts

The development proposal will increase noise and light pollution within the project area, which may cause added disturbance to Growling Grass Frog populations.

Noise pollution in urban environments, particularly from surrounding roads or aeroplane fly-over, can disrupt acoustic communication between frogs (i.e. calling), by reducing call signal detection, and impairing the recognition and deciphering of call signals (Parris 2013). Noise pollution has been shown to affect call rate, pitch and volume and the ability of females to detect and locate calling males (Sun and Narins 2005; Parris *et al.* 2009; Hoskin and Goosem 2010; Parris 2013), thereby affecting breeding behaviour. Larger frog species with lower frequency calls, such as Growling Grass Frogs, are predicted to suffer the greatest reduction in communication distance from road noise. Models suggest that frogs the size of the Growling Grass Frog will experience reduction of 81-94% in maximum distance of call detection between quiet (rural) versus noisy (urban) wetlands (Parris 2013). There is some evidence to suggest that constant noise pollution also causes chronic physiological stress (e.g. Kaiser *et al.* 2015). Long-term physiological stress can lead to suppression of the immune system and increasing susceptibility to disease.

The impacts of noise pollution appear to increase proportional to the level of noise disturbance. During construction, noise levels are expected to be elevated substantially from background conditions. Construction noise disturbance will be most intense during construction of the habitat corridor, because of the proximity to Growling Grass Frog habitats. Noise pollution from construction machinery will be reduced as far as possible through standard noise control measures, compliance with Environment Protection Authority noise control guidelines and City of Whittlesea planning permit requirements. In addition, all construction works will be undertaken during daylight hours; although Growling Grass Frogs may be active by day and night during spring and summer, activity levels are generally higher at night.

Once construction is completed, the level of increase in ambient noise as a result of the development is difficult to predict. It is expected that there will be some increase in noise levels due to local traffic along local roads adjacent or proximate to wetlands. However, noise levels from major roads are likely to have a greater effect on frog populations. The project site is located within an urban landscape, bordered by two arterial roads (Cooper Street and Edgars Road) and traffic volumes on these roads are likely to increase with population growth in the region independent of the proposed development.

Levels of artificial light will also increase under the proposed action. Artificial lighting will not be utilised during construction, as construction will be restricted to daylight hours; however, ambient levels of light will increase following the development, from adjacent streetlights, lighting on footpaths and residential and commercial buildings surrounding the proposed habitat corridor. In general, artificial lighting has the potential to impact on fauna by attracting or deterring animals for certain areas, disrupting natural light cycles and circadian rhythms, affecting physiology, causing disorientation, affecting eyesight, impacting foraging or increasing the risk of predation (i.e. by increased exposure).

The impacts of artificial lighting on amphibians have not been well researched (Buchanan 2005); however, given that Growling Grass Frogs are largely nocturnal, it is reasonable to suspect that high levels of artificial lighting would cause some disturbance. Artificial lighting may impact Growling Grass Frogs if it disrupts circadian rhythms, or alters behaviours such as breeding or foraging behaviour, but the risks of such impacts are uncertain. Some research suggests that artificial lighting has the potential to impede the ability of frogs to located and capture prey, most likely due to the time taken for a frog's

eyes to adjust to the higher levels of light (Cornell and Hailman 1984; Buchanan 1993). In Green Tree Frogs (*Litoria clamitans melanota*), artificial light at night has been shown to reduce advertisement calls and increase movement, potentially to reduce predation rates. This may have flow on effects for reproduction (Baker and Richardson 2006). Finally, exposure to artificial light at night may cause physiological stress which may lead to suppression of the immune system as well as other impacts (Navara and Nelson 2007). These impacts can be mitigated through careful design and use of fauna-friendly lighting (see Section 7.4.14).

While the precise extent of impacts from noise and artificial light are uncertain, we note that a number of Growling Grass Frog populations have persisted in similarly developed urban areas, including the Village Park population in Caroline Springs referred to earlier. Some of these potential impacts can be mitigated through the use of ecologically sensitive design (e.g. controlling light spill, Section 7.4.14).

### 5.1.4 Population-level impacts

#### Regional impacts

The Growling Grass Frog is known from several locations along Edgars Creek, predominantly within and upstream of the study area (Figure 3 and Figure 4); they include stormwater treatment wetlands directly north of Coopers Street, and at the Aurora development, approximately 4 km to the north of the project area (D. Gilmore, pers. comm.). The level of connectivity between Growling Grass Frog populations in Edgars Creek is uncertain, although it seems likely that periodic movements would occur between the project site and stormwater treatment wetlands directly north of Cooper Street. Direct connection with the Aurora population would almost certainly be rare, primarily due to the distance between these sites, which is several times larger than the typical long-distance movements of individual Growling Grass Frogs (Heard *et al.* 2010). Any movements that do occur between the Aurora metapopulation and the project area would be more likely in a downstream direction (e.g. eggs/tadpoles transported during high flow events).

Growling Grass Frogs have also been recorded from the Melbourne Market relocation site, directly to the west of the project area, at culvert entrances beneath Edgars Road and within a disused quarry pit (see Figure 3). This site formed part of a sub-regional strategy for the Growling Grass Frog (Ecology Australia 2005, 2006), and to this regard, stormwater treatment wetlands and purpose-built Growling Grass Frog wetlands were built along the southern boundary of that site (i.e. along Deveney Road) in 2012. Growling Grass Frogs are infrequently recorded from that site; a few individuals were recorded from the Quarry Pit in 2011 (Ecology Australia, unpubl. data) and have since only been recorded within the constructed wetlands (including during the 2018-19 breeding season. Regular movements through the lengthy culverts under Edgars Road are unlikely. However, constructed wetland 1 will be immediately adjacent to these culverts, so connectivity with this adjacent population may improve.

Potential regional level impacts could occur where the proposed development reduced the occupancy or viability of the population at the study area; these potential impacts include the following:

- Reduced viability of the regional (meta)population, through a decrease in frog occupancy and abundance at the site;
- Reduced persistence of populations at surrounding sites through reduced connectivity resulting in increased local extirpation and/or decreased colonisation of suitable habitat (sensu Heard *et al.* 2010; 2012).

The proposed development will not create any additional barriers to the movement of Growling Grass Frogs between the project area and other populations. The likely persistence of the local population in the longer term under two scenarios (the existing wetland arrangement versus the proposed habitat corridor) was modelled (see Section 4.1.1). Modelling results suggest that the proposed habitat corridor would see similar or slightly higher occupancy of wetlands over 40 years than the current wetland arrangement (Ecology Australia 2016b); these results were based on the seven created permanent wetlands in the habitat corridor, and did not include the three managed ephemeral wetlands added subsequently. Hence, provided that the modelling assumptions are met (e.g. 'best-practice' construction and management of wetlands and road crossings), the modelling results suggests that the proposed action is unlikely to result in a material decrease in the viability of the local population, and, by extension, is unlikely to reduce the viability of surrounding metapopulations through a reduction in connectivity from or through the site.

We note that along the southern boundary of the site, a council road was recently constructed (i.e. the continuation of Deveny Road), which intersects Edgars Road at a new signalised intersection. Construction of this sealed road includes construction of a culvert structure to span across Edgars Creek. Given the lack of records of Growling Grass Frogs within c. 5 km to the south of the site on or around Edgars Creek (Figure 3), any reduction in connectivity to the south of the site (i.e. from the construction of Deveny Road) is unlikely to materially impact the dynamics or viability of the broader metapopulation.

Uncertainty regarding potential impacts of the proposed New Epping development will be reduced if the constructed wetlands and associated terrestrial habitat facilitate successful breeding and meet the life-cycle requirements of the species in the long-term, and the new habitat corridor maintains existing connectivity with regional populations.

### 5.1.5 Summary of potential impacts to Growling Grass Frog

Stage 1 of the proposed action will have a significant impact on the Growling Grass Frog. The following is a summary of the types and extent of potential impacts, in the absence of mitigation, to the Growling Grass Frog and its habitat under the proposed redevelopment of the site:

- Habitat removal:
  - Ten existing wetlands, covering 1.98 ha;
  - Approximately 6.28 ha of riparian habitat (within 30 m of wetlands);
  - ~~Approximately 39.7 ha of terrestrial habitat, although the 30.6 ha of this would likely be rarely utilised by Growling Grass Frogs~~ (e.g. the capped landfill); and
  - Temporary removal of riparian habitat along Edgars Creek during waterway remediation, and the removal of the drainage line in the northeast of the site.
- Changes to habitat quality that may include:
  - Reduced cover of fringing, emergent, submergent and floating vegetation.
  - Changes to the hydrology of Edgars Creek and off-channel wetlands, including altered water permanence
  - Altered water quality; the potential effects of these changes on the Growling Grass Frog are uncertain, and it is possible that some changes may be positive.

Refer to update #35

  - Increased shading; current shading of wetlands at the site (i.e. from trees and woody shrubs) is generally very low.
  - Increased artificial noise and light.
- Impacts to individuals, including mortality during habitat removal and construction works, increased prevalence or intensity of disease, and increased disturbance (e.g. noise, artificial light, disturbance from people/domestic animals).
- Regional population changes, including decreased occupancy or abundance of local and nearby populations, or reduced connectivity between the metapopulation.

Management actions proposed to address these impacts are provided in Section 7.

## 5.2 Potential impacts to the Golden Sun Moth

Golden Sun Moth habitat within the project area covers 5.532 ha (Ecology Australia 2015), located almost exclusively within Stage 2 of the proposed action (315W and 325C Cooper Street parcels; Figures 1, 3 and 4). Under the proposed development, all Golden Sun Moth habitat will be removed. Removal of the habitat will result in the loss of the remnant local population at the site (i.e. complete mortality after removal of the vegetation and top soil). As such, local impacts associated with habitat fragmentation or shading (and disruption of the life-cycle) are not relevant to the proposed action, and are not discussed further here. The loss of Golden Sun Moth habitat within the project area is proposed to be offset in the Western Grassland Reserve (see Section 7.4.18).

### 5.2.1 Regional Impacts

The Melbourne Market site on the western side of Edgars Road historically supported a relatively large population of Golden Sun Moth. The size of this local population appears to have declined substantially with development on the site and significant degradation and loss of habitat. Over the past five years, individual moths have been recorded incidentally during the flight-season within the remaining undeveloped portion of the site, although this area is also earmarked for development in the future (Ecology Australia, unpubl. data). The project area is separated from the Melbourne Market relocation site by approximately 50 m, over the four lanes of Edgars Road (Figure 3). Individual moths may move between these two sites during the flight season. However, functional connectivity (e.g. the regular exchange of genetic material) between these two sites is likely low, due to the:

- low dispersal capacity of Golden Sun Moths(Clarke and O'Dwyer 2000);
- physical barrier created by Edgars Road;
- apparent small size of the population in the project area (7 individuals recorded in 2015, Ecology Australia 2015); and
- apparent population decline at the neighbouring Melbourne Market relocation site caused by significant habitat loss.

Further clusters of Golden Sun Moth records occur approximately 2 km north of the site (Figure 3); these populations have been identified from survey work undertaken for specific developments, thus some of these populations may have been lost, while additional populations might occur in the surrounding landscape where targeted surveys have not been undertaken. Given that populations separated by more than 200 m are considered to be effectively isolated (DoEE 2017), extant populations

c. 2 km or more from the study area are highly unlikely to be functionally connected to the population within the project area .

In summary, Stage 2 will have a significant impact on the small Golden Sun Moth population at the New Epping site; noting there is a very small area of potential Golden Sun Moth habitat impacted by Stage 1. Based on the spatial ecology of the species and the distribution of past records, the proposed loss of c. 5.5 ha of Golden Sun Moth habitat at the site, which is proposed to be offset in the Western Grassland Reserve (Section 7.4.18), is considered unlikely to significantly impact on the viability of Golden Sun Moth in the region.

# 6 Stakeholders

The following organisations, groups and departments will be involved in the approval and implementation of this Environmental Management Plan:

- **Riverlee** – proponents of the proposed development. They will be required to adhere to the recommendations of this EMP during the design, pre-construction, construction and post-construction stages of the development. Riverlee will be responsible for the management of the habitat corridor for at least the 10 year management period (i.e. the 10 years following the completion of the habitat corridor).
- **Federal Department of Environment and Energy (DoEE)** – will be responsible for overseeing the implementation of this plan as well as granting approval and permit conditions in accordance with the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- **Victorian Department of Environment, Land, Water and Planning (DELWP)** – will be responsible for overseeing the implementation of this plan and assessing the suitability of this plan under the Victorian *Flora and Fauna Guarantee Act* (FFG Act) as a referral agency under permit applications.
- **City of Whittlesea** – is the responsible authority for the planning matters at the study area and will be responsible for considering and determining permit applications. They may ultimately have a role in the ongoing management of the habitat corridor after the 10-year management period is completed. .
- **Melbourne Water** – will be responsible for the approval of the Edgar's Creek realignment (due to drainage scheme function). Melbourne Water are expected to take control of the management of the waterbodies on site after the 10 year management period).
- **Merri Creek Management Committee** – an integrated management agency involved in environmental issues relating to the development and management of land within the Merri Creek Catchment.
- **Friend of Merri Creek and Friends of Edgars Creek** – community based groups that work actively to restore and protect the Merri Creek and Edgars Creek and their tributaries and environs.
- **Ecology Australia Pty. Ltd. (EA) and Wildlife Profiles (WP)** – authors of the initial flora and fauna assessments (EA), frog assessments (WP and EA), Preliminary Documentation (EA) and this EMP (EA). ~~Both companies may be involved with the implementation of this plan including on ground monitoring and other operations during construction and post-construction.~~

Refer to update #36

# 7 Environmental Management Plan

## 7.1 Objectives

The objective of this Environmental Management Plan (EMP) is to outline the management actions and protocols during the pre-construction, construction and post-construction phase to ensure that the local Growling Grass Frog population is maintained in the long term and adequate, suitable habitat is created in the habitat corridor. Impacts to the Golden Sun Moth are covered in less detail, as the local population will be removed and offset in the Western Grassland Reserve. Specific management actions and their associated performance measures are provided in Table 7. This EMP covers the following key elements:

- Staged development.
- Protecting existing Growling Grass Frog habitat during the pre-construction phase.
- Creek realignment and revegetation, the construction of Growling Grass Frog wetlands and establishing the habitat corridor during the pre-construction phase.
- The Growling Grass Frog migration phase.
- Adaptive management phase (if required).
- Habitat management and ongoing revegetation as required.
- Appropriate development design to reduce shading, noise and artificial light at night.
- The construction phase.
- Invasive species management.
- Salvage and relocation.
- Fencing.
- Chytrid management.
- Post-construction monitoring.

## 7.2 Timeframe

The management strategies outlined in this plan will be implemented once Riverlee has received approvals and permit conditions from DoEE and the City of Whittlesea. This EMP will operate from the date of approval and throughout construction. Once the habitat corridor is successfully established, the migration and adaptive management phase are complete and existing Growling Grass Frog habitat outside the habitat corridor is removed this EMP will be replaced by an on-site offset management plan (OMP). Management actions will occur for the 10 year management period in accordance with the EPBC Act approval (i.e. 10 years after the completion of the habitat corridor).

After ten years, monitoring requirements for Riverlee will either cease or continue based on an agreement with DoEE and DELWP. After the 10 year management period, the habitat corridor will be handed over to Melbourne Water to manage in perpetuity. After the 10-year management period, the management plan will be updated with the knowledge gained over the 10 year period.

Works required to fulfil the aims of this EMP will vary year to year, and the timing and staging of work will be important in order to maintain the Growling Grass Frog population and establish new habitats.

This EMP will be audited approximately three times as follows:

1. When habitat corridor is constructed (approximately 12 months from the commencement of the action, i.e. when construction of the habitat corridor commences)
2. Following migration/adaptive management phase (approximately 36 months from the commencement of the action)
3. Following the removal of the existing Growling Grass Frog habitat outside the habitat corridor, when this EMP will be superseded by the OMP.

If construction and establishment of the habitat corridor and removal of existing habitat takes longer than expected, additional audits may be required (audits are required every 24 months after the first 12 months under the EPBC Act approval). The audits will be by an ecologist in conjunction with DoEE and Riverlee to determine if any changes are necessary. See section 11.2 for further information. Once it comes into force, the OMP will be audited every two years.

## 7.3 Responsibility for implementation

Riverlee is responsible for the implementation of this EMP. The requirements outlined in this plan will be incorporated into the site environmental management plan for the New Epping development. Ongoing liaison between Riverlee, their contractors, DoEE and qualified zoologists will ensure actions outlined in this EMP are implemented.

## 7.4 Management Actions

Management actions are outlined below, and summarised in Table 9.

Note that the much of the development proposal and management actions outlined below have been approved under EPBC Act Approval 2016/7755 (Ecology Australia 2018).

### 7.4.1 Staged development

Staged development of the New Epping precinct aims to give the Growling Grass Frog a smooth transition from existing to new wetlands. Prior to the removal of existing wetlands, new wetland habitat will be established and Growling Grass Frogs will be allowed time to migrate to and establish breeding populations in these constructed wetlands. The main actions to achieve this aim and their proposed timing pending approvals, construction and migration times are outlined below and in Table 2. Note that construction in non-Growling Grass Frog habitat precincts (the Urban and Health Quarters) may commence during the pre-construction phase.

#### Management actions

1. Pre- construction phase, principally relating to the establishment of the habitat corridor and new Growling Grass Frog populations. Late 2019-April 2023.

Refer to update #37

(i) ~~Late 2019~~. Establish signed and fenced “no go” zones around existing Growling Grass Frog habitat (Figure 9) to prevent construction personnel, equipment and vehicles impacting Growling Grass Frog populations (see Section 7.4.2). Note that a small section

(0.12 ha) of existing Growling Grass Frog habitat will not be included in the no-go zone, as this area needs to be removed to accommodate the constructed wetlands. Pre clearance searches and, if required, salvage and relocation will be undertaken in these areas in accordance with procedures outlined in section 7.4.16.

Refer to update #37

(v) ~~Late 2019~~ to Q3 2020. Construction of habitat corridor, including the realignment of Edgars Creek (see Section7.4.4) and construction of in-stream and off steam wetlands (Section 7.4.5).

Refer to update #37

(vi) ~~Mid 2020~~ until the established habitat is complete. Revegetation of the habitat corridor, including Edgars Creek, new constructed wetlands and the surrounding terrestrial environment.

Refer to update #37

(vii) ~~October 2020 until April 2022. 'Frog migration' period of 20 months covering two breeding seasons to allow the frogs to colonise constructed wetlands and establish breeding populations.~~

Refer to update #38

Refer to update #37

(viii) ~~Early 2021 until April 2023~~. 'Adaptive management' period (if required) to improve habitat quality in constructed wetlands and implement pre-construction salvage of individuals and relocation to constructed wetlands.

2. Construction phase in the Green Quarter, including salvage and relocation of Growling Grass Frogs from existing habitats and the removal of existing Growling Grass Frog habitat. ~~April 2022 until mid-2024. Following this phase, this EMP will be superseded by the OMP~~.

Refer to update #39

Refer to update #40

3. Post-construction phase involving the management and maintenance of the habitat corridor and monitoring of Growling Grass Frog populations in accordance with the OMP (approximately ~~mid 2024 to late 2029~~) pending discussion with government agencies.

Refer to update #41

### Performance targets

- Timeline adaptable to ensure that the two breeding season frog migration period is kept following the construction of the habitat corridor, and prior to the removal of existing Growling Grass Frog habitat.
- Adaptive management implemented if necessary (see section 7.4.9).
- Habitat corridor managed and maintained for the 10 year management period (See section 7.4.6 and on site OMP).

### Corrective action

- If the completion of the habitat corridor is delayed beyond October 2020, the frog migration phase will be extended to cover two breeding season following the completion of the habitat corridor. For example if the habitat corridor is not completed until January 2021, the migration phase will continue until April 2023 and the adaptive management phase will run to at least April 2024 if required.

Refer to update #42

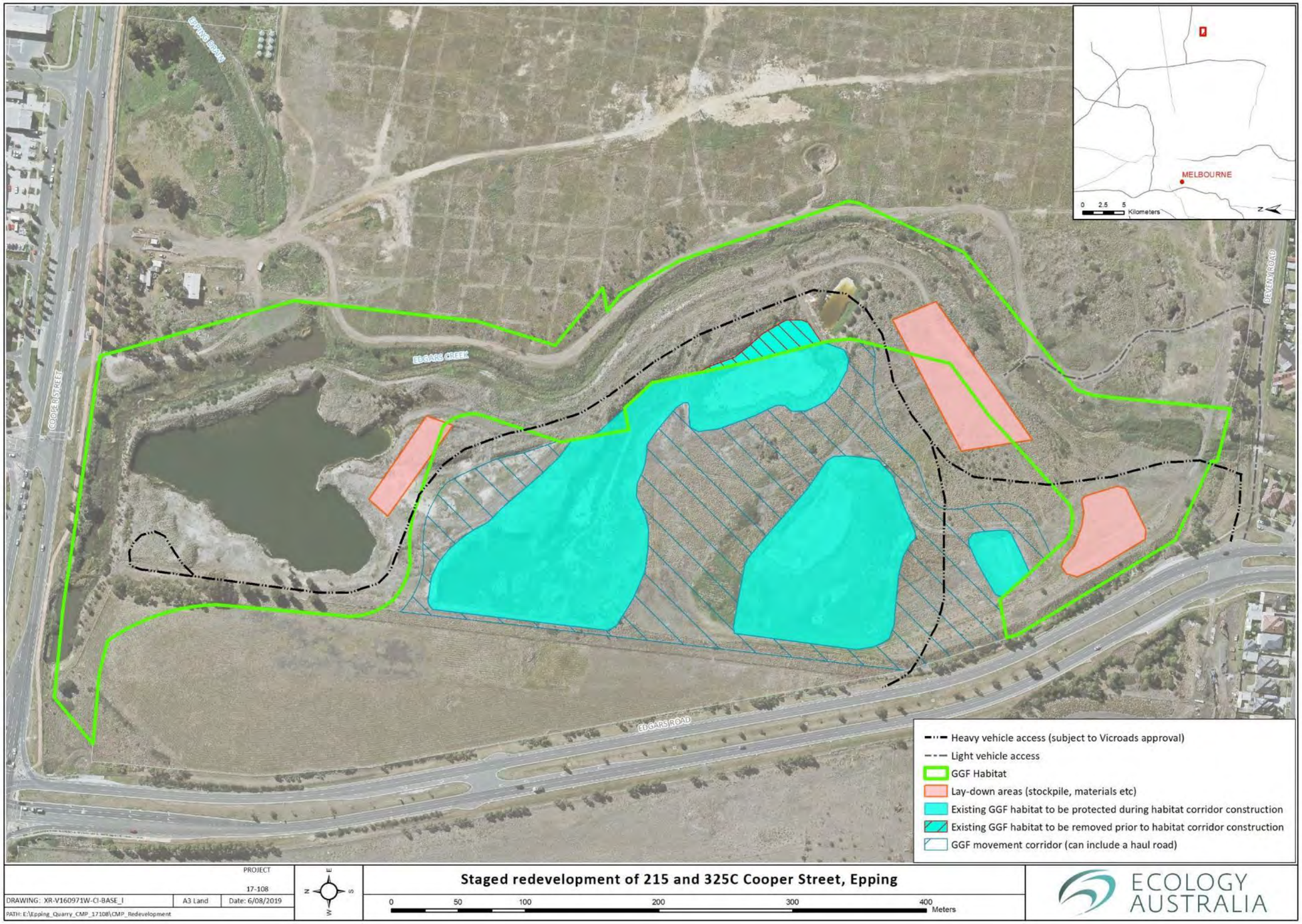



**Figure 9 Existing Growling Grass Frog habitat and areas to be protected and removed during the construction of the construction of the corridor (no-go zones) and indicative lay-down areas and haul roads.**

### 7.4.2 Pre-construction habitat protection

Pre-construction habitat protection aims to protect existing Growling Grass Frog habitat while the habitat corridor is established and the frog migration phase occurs. The areas outlined in Figure 9 will be designated as no-go zones until the end of the migration/adaptive management phase.

#### Management actions

- Protect existing wetlands and suitable terrestrial habitat prior to construction works commencing with appropriate fencing, and install sediment and pollution control measures where applicable (e.g. areas where flow is directed towards existing wetlands.
- Place signage along the fence to demonstrate to contractors that the area is a 'no-go zone' during the establishment of the habitat corridor and frog migration period.
- No vehicles or personnel will be allowed to enter the no go zone unless authorised to do so (e.g. to survey Growling Grass Frogs).
- No dumping of soil or other materials in the no go zone.
- Discuss the no-go zones during on site inductions.

#### Performance criteria

- Fencing with no go zone signage erected prior to the construction of habitat corridor.
- Sediment and pollution control measures installed where flows are directed to existing habitat.
- Fencing and no go area regularly inspected and fencing fixed as required.

#### Corrective actions

- Improve signage and site inductions.
- Improve sediment control measures in areas draining into existing habitats.

### 7.4.3 Habitat removal during the construction of the habitat corridor.

A small section of existing Growling Grass Frog habitat (0.12 ha) will need to be removed prior to or during the construction of the habitat corridor (Figure 9). This area encompasses a small section of existing Wetland 4 and associated riparian habitat. Up to five Growling Grass Frog were recorded in the area to be cleared during surveys in 2016-17; this section of the wetland supports a small spring fed soak in some years (Ecology Australia 2017a). Wetland 12 will also be modified to accommodate the new drain and improve hydraulic performance; Growling Grass Frog are known from this wetland and surrounding vegetation (Ecology Australia 2017a & in prep.). Growling Grass Frog searches and, if required, salvage and relocation will be undertaken in these areas immediately prior to habitat removal.

#### Management actions

- Protect habitat to be removed with no go fencing until immediately prior to removal.
- Minimise the area to be cleared as much as possible.

- Immediately prior to habitat removal (i.e. within 72 hours), Growling Grass Frog searches and, if required, salvage and relocation should be undertaken in accordance with protocols outlined in Section 7.4.16.

#### Performance criteria

- Salvage and relocation occurs within 3 days of works in existing wetlands following guidelines outlined above
- Growling Grass Frogs not recorded in area immediately prior to removal of wetlands.

#### Potential corrective actions

- If Growling Grass Frog recorded in area following salvage and relocation operations, conduct another round of salvage and relocation.

### 7.4.4 Remediation of Edgars Creek

The remediation of Edgars Creek will involve the excavation of the creek bank and creek bed to improve stability, flow and the corridor's suitability as Growling Grass Frog habitat. Habitat will be improved by making the slope gradients along the creek line more variable, creating shallow banks and establishing four in-stream pools.

#### Management actions

- Planned realignment has undergone hydraulic assessment.
- Planned realignment has been approved by Melbourne Water.
- Install erosion control devices, such as geotextiles or coir logs, to prevent erosion prior to the establishment of vegetation along the creek line.
- Establish shallow banks with a variable littoral zone similar to those outlined in section 7.4.5. Such habitats can provide areas of warmer water and higher productivity and vegetation growth, and potentially increase tadpole development and supress Chytrid fungus. In addition, they provide habitat for perching and foraging.
- The design and construction of the four in-stream pools will follow those outlined in section 7.4.5.
- Flora species native to the region will be used for revegetation, as outlined in section 7.4.6.
- Cleared trees and rocks should be stockpiled for use during the construction of the habitat corridor.

#### Performance criteria

- Construction matches approved design.
- Riparian habitat and in stream pools meet Growling Grass Frog design criteria.
- Salvage and relocation conducted in wetland 12 prior to habitat removal.

#### Corrective actions

- Modify creek bed to improve habitat quality for Growling Grass Frog

- See section7.4.5, 7.4.6 and 7.4.9 for additional corrective actions to improve habitat quality.

### 7.4.5 Wetland configuration, design and construction

The wetlands to be constructed in the habitat corridor will incorporate habitat attributes important for the Growling Grass Frog (DELWP 2017b). The ponds will be specifically designed for Growling Grass Frogs and include gentle bank slopes, varying depths and fringing, emergent and submergent vegetation zones. The wetlands will be located off the main channel of Edgars Creek. The wetlands will also be close enough together to maintain connectivity between the ponds. The design includes seven permanent and three ephemeral wetlands. These wetlands will be between 0.05 ha and 0.3 ha in size. They will be supplemented by four small (0.036-0.056 ha) in-stream wetlands at the southern end of Edgars Creek. The total area of proposed wetlands will be approximately 1.16 ha.

The 1.52 ha main quarry pit will be retained.

Note that the habitat corridor design, including wetland layout, area and design, and corridor width have been approved by the DoEE (EPBC 2016/7755).

#### Wetland layout

The layout of wetlands for the proposed New Epping development includes seven new permanent off-stream wetlands; five south of the proposed road bridge over Edgars Creek and two associated with the retained main quarry water body. In addition, there will be three ephemeral wetlands, one south of the bridge and two associated with the retained quarry water body (Figure 6 and Figure 7). These will be supplemented with four in-stream wetlands south of the proposed bridge and one existing in-stream wetland (Wetland 12, Figure 1). A large proposed wetland (P1) will be adjacent to existing culverts under Edgars Road that lead to existing constructed Growling Grass Frog wetlands on the Melbourne Wholesale Markets, which will potentially aid in regional population connectivity.

The layout and construction of wetlands is based on best practice guidelines (DELWP 2017b).The habitat corridor meets the definition of a Growling Grass Frog wetland ‘node’ under the Melbourne Strategic Assessment guidelines. Wetland layout met the relevant criteria outlined in the Growling Grass Frog design standards (DELWP 2017b), specifically:

- **Cluster contains at least 10 off-stream wetlands, including existing wetlands.** The design includes 11 off stream wetlands.
- **Wetlands less than 200-300 m apart.** No wetland is more than 150 m from a neighbouring wetland and most are only 20 m to 50 m away from their nearest adjacent wetland. The proposed bridge over Edgars Creek will follow the crossing design standards for Growling Grass Frogs (DELWP 2017c) so that movement is not restricted and connectivity is maintained (see below).
- **Variety of wetland types within a cluster**. Wetlands are of varying size and hydroperiod.
- **All wetlands off-stream**. Yes. However there will be four small in-stream wetlands in addition to the 11 outlined above.

The effectiveness of the proposed layout on the persistence of the local Growling Grass Frog population was assessed using modelling to ensure the long term survival of Growling Grass Frogs on site (Ecology Australia 2016b). The model simulated the occupancy dynamics of the Epping Site metapopulation of

Growling Grass Frogs, using a model that combined those developed by (Heard *et al.* 2013, 2015). The model enabled wetland occupancy by Growling Grass Frogs to be projected into the future (and hence future metapopulation viability to be estimated). The model was built using an 11 year monitoring dataset for Growling Grass Frogs collected at 190 sites in the Darebin, Merri and Moonee Ponds Creek catchments, entailing some 2,011 surveys between 2001 and 2012. Monitoring data from the Epping site were included in the dataset so the model is directly applicable to the study area.

The model evaluated changes in wetlands occupancy, starting from the pattern of occupancy recorded by Wildlife Profiles (2015), over a 40-year timeframe. It assumed that created wetlands (at that time 7 permanent wetlands) would be 'best practice' (see below) and would align with the Melbourne Strategic Assessment draft guidelines available at the time(Biosis 2015).

The modelling results showed that within the proposed habitat corridor, which at the time consisted of seven permanent wetlands to be created, occupancy over 40 years would be similar to that if existing conditions were maintained. Importantly, an additional three 'managed ephemeral' wetlands have been added to the habitat corridor subsequently, as well as four in stream wetlands.

*Management actions and performance criteria*

- Constructed wetlands match the wetland layout design (Figure 6 and Figure 7).

*Corrective action*

- If not correctly constructed, modify wetlands to meet proposed design.

### Wetland area

The total area of created wetlands will be 1.33 ha, including 1.16 ha of off stream wetlands (Table 4). This is 0.83 ha less than the 1.98 ha of off stream to be removed as part of the development. However several of the existing wetlands have marginal or no Growling Grass Frog habitat under prevailing conditions. Wetlands that have been known to support large breeding populations (Wetlands 2 and 3, Figure 2) equate to roughly 0.88 ha. The planned wetlands will be specifically designed to provide high quality Growling Grass Frog habitat, so it is likely that the deficit in habitat area will be offset by an increase in habitat quality.

The proposed wetlands will be between 0.04 ha and 0.3 ha in size (Table 4). The large quarry hole wetland (Wetland 1, 1.5 ha) meets the habitat standard that at least one wetland should be large (>0.7 ha). However, the design falls short of the habitat criterion that most wetlands must be at least 0.3 ha, or when space is limited, wetlands must be at least 0.15 ha and the submergent zone at least 0.1 ha. Only one retained and one created wetland will be >0.3 ha. The remaining permanent wetlands will be between 0.08 and 0.2 ha and the managed ephemeral wetlands will be approximately 0.05 ha. While the surface areas of many of the proposed wetlands fall short of design criteria, as outlined above, modelling suggests that the proposed design will at least match current occupancy rates. Hence failing to meet these design criteria is unlikely to impact population persistence, and the wetland areas have been approved under EPBC 2016/7755

Constructing the proposed 1.33 ha of high quality Growling Grass Frog habitat on site meets 68.7% of Riverlee's quantum of impact as determined by the DoEE Offsets Assessment Guide calculator (DSEWPaC 2012; Ecology Australia 2018). As a result the remaining 31.3% will be offset off site by purchasing, managing and protecting high quality Growling Grass Frog habitat at an offset site along the

Perry River near Sale. Growling Grass Frog habitat and populations at the Epping site will be managed and monitored in accordance with management actions outlined in this EMP and the onsite OMP. Growling Grass Frog at the offsite offset will be managed in accordance with an offsite Offset Management Plan.

*Management action and performance criteria*

- The wetland areas will match or exceed those outlined in the proposed habitat corridor design.
- Offset the remaining 31.3% of impact using direct offsets at an appropriate off site location with high quality Growling Grass Frog habitat.

*Corrective action*

- If not correctly constructed, modify wetlands to meet proposed design.

**Table 4 Proposed and existing wetlands to be created, retained and removed at the New Epping site and their location and hydroperiod.**

Refer to update #43

| Wetland number and description | Hydroperiod | Location | Size ($m^2$) |
|---|---|---|---|
| **Wetlands to be removed (Figure 2)** | | | |
| 2 – Quarry hole | Permanent | Off-stream | 3,500 |
| 3 – Quarry hole, shallow extension of '2' | Permanent | Off-stream | 5,720 |
| 4 – Large 'lime pond', extension of '3' | Permanent | Off-stream | 3,080 |
| 5 – small 'lime pond' | Permanent | Off-stream | 580 |
| 6 – small clay dam | Permanent | Off-stream | 230 |
| 7 – large clay dam | Permanent | Off-stream | 660 |
| 8 – Shallow artificial marsh | Ephemeral | Off-stream | 3,270 |
| 9 – shallow ephemeral pond | Ephemeral | Off-stream | 1,030 |
| 10 – shallow ephemeral pond | Ephemeral | Off-stream | 1,260 |
| 11 – small pool in Edgars Creek | Ephemeral | In-stream | 180 |
| 13 – shallow ephemeral depression | Ephemeral | Off-stream | 500 |
| **Total wetlands removed** | | | **20,010** |
| **Wetlands to be retained (Figure 2)** | | | |
| 1 – large quarry hole | Permanent | Off-stream | 15,200 |
| 12 – large planted pool in Edgars Creek | Permanent | In-stream | 1,360 |
| **Total wetlands retained** | | | **16,560** |
| **Wetlands to be constructed (Figure 6)** | | | |
| P1 | Permanent | Off-stream | 3,050 |
| P2 | Permanent | Off-stream | 1,000 |
| P3 | Permanent | Off-stream | 1,360 |
| P4 | Permanent | Off-stream | 820 |

| Wetland number and description | Hydroperiod | Location | Size ($m^2$) |
|---|---|---|---|
| P5 | Permanent | Off-stream | 880 |
| P6 | Permanent | Off-stream | 820 |
| P7 | Permanent | Off-stream | 2,000 |
| E1 | Managed Ephemeral | Off-stream | 500 |
| E2 | Managed Ephemeral | Off-stream | 440 |
| E3 | Managed Ephemeral | Off-stream | 650 |
| I1 – northern | Permanent | In-stream | 363 |
| I2 – north central | Permanent | In-stream | 453 |
| I3 – south central | Permanent | In-stream | 451 |
| I4 – southern | Permanent | In-stream | 557 |
| **Total wetlands constructed** | | | **13,344** |
| **Total off-stream wetlands prior to development** | | | **35,030** |
| **Total off-stream wetlands following development** | | | **26,720** |
| **Total in-stream wetlands prior to development** | | | **1,540** |
| **Total in-stream wetlands following development** | | | **3,184** |

### Wetland design

Created wetlands will be designed to have areas of deep (>1.5m) water and a dense cover of submergent and floating vegetation to prevent the dominance of tall emergent vegetation. In addition there will be shallow areas with some emergent vegetation, rocky areas and a variable littoral zone.

The design criteria outlined below meet the majority of Growling Grass Frog Melbourne Strategic Assessment habitat standards (DELWP 2017b). However, in some instances, the proposed design is only likely to meet some criteria and in one instance it will not meet the design criteria (Table 5).

Wetland design will meet the following design criteria:

- 50% of wetlands are ‘anti-chytrid’, that is they have a high rock cover, warm shallows and moderate salinity
- Emergent vegetation zone will cover 30-40% (Table 5) and will include a littoral zone with fluctuating water levels.
- Wetlands will have an extensive shallow, permanently inundated zone.

Wetland design will not meet the following design criteria:

- The deep water zone (maintained at a depth of greater than 1.5 m) should cover 50% of all wetlands.
  - The proposed wetlands at New Epping will all reach 1.5 m deep, but this area will cover approximately 30-50% of the wetlands (Table 5).

Failing to meet this design criterion will have minimal impact if water levels in the wetlands are effectively managed and adequate submergent vegetation is planted. The proposed wetland design has been approved under EPBC 2016/7755

**Table 5 ~~Size of each Growling Grass Frog pond, and area of each pond that is shallow, intermediate and deep in meters and percentages.~~**

Refer to update #44

| GGF Pond | | Total Area | Shallow (0-0.5 m) | Intermediate (0.5-1.5 m) | Deep (1.5 m) |
|---|---|---|---|---|---|
| Pond 1 | $M^2$ | 3050 | 1255 | 745 | 1051 |
| | % | | 41% | 24% | 34% |
| Pond 2 | $M^2$ | 987 | 307 | 354 | 326 |
| | % | | 31% | 36% | 33% |
| Pond 3 | $M^2$ | 1355 | 365 | 497 | 492 |
| | % | | 27% | 37% | 36% |
| Pond 4 | $M^2$ | 820 | 262 | 263 | 295 |
| | % | | 32% | 32% | 36% |
| Pond 5 | $M^2$ | 887 | 259 | 241 | 386 |
| | % | | 29% | 27% | 44% |
| Pond 6 | $M^2$ | 791 | 229 | 246 | 316 |
| | % | | 29% | 31% | 40% |
| Pond 7 | $M^2$ | 1945 | 506 | 454 | 985 |
| | % | | 26% | 23% | 51% |

*Management actions.*

The following wetland design parameters must be incorporated into all GGF wetlands:

- Depth will vary across each wetland, with areas of permanent and ephemeral habitat. The approximate depths and ratios of each wetland zone will be as follows:
  - Embankment/drawdown zone: this area will be between 0 – 0.5 m deep, and will cover approximately 30-40% of the wetland area;
  - Open water: this area will be between 1 – 1.5 m deep, and will cover approximately 25-40% of the wetland area;
  - Deep open water: 1.5 m in depth, and will cover approximately 30-50% of the wetland area. The aim of the deep water area is to both maintain permanent water irrespective of weather and hydrological conditions, and to promote submergent vegetation.
- Wetland embankments will grade from 1 in 8 nearshore (1 in 3 in some areas) to 1 in 3 as the water deepens. Steep-sided wetlands are less favourable for the Growling Grass Frog (Figure 10).
- The wetlands will be created off-line from the main channel of Edgars Creek (above the 1 in 10 year ARI), and must be designed to allow the draining of the wetland if required (e.g. all

water can flow to a single deep section to allow for pumping out). Wetlands may be drained if populations of predatory species, such as Eastern Gambusia, become established or excessive sedimentation occurs.

- Dense submergent and floating vegetation will be planted to ensure 30-50% cover by the second year of the Growling Grass Frog migration period.
- Maintain an optimal hydrological regime for created wetlands. Permanent GGF wetlands must not be allowed to dry out completely (i.e. need to maintain a permanent hydroperiod), particularly between September and March (the breeding period). This is to ensure habitat is available for tadpoles to metamorphose over the summer months. Changes to the hydrological regime also impacts Growling Grass Frog habitat through the alteration of aquatic vegetation communities, given the sensitivity of these plants to water depths and length of inundation (Heard and Scroggie 2009). Water levels in GGF wetlands will not fall below a minimum depth of 0.5 m in the open water areas (i.e. across approximately 70% of wetland); if this water level is reached, recharge measures will be implemented. See below for further details.
- Managed ephemeral wetlands have been designed to dry up outside of the breeding season (i.e. the reverse of natural ephemeral wetlands that dry out over summer); while this reduced hydroperiod is potentially detrimental for Growling Grass Frog, it can also be beneficial through the regular eradication of Gambusia and potential decline in chytrid within these wetlands. Managed ephemeral wetlands have been shown to have positive effects in other Growling Grass Frog populations.
- Wetlands will be clay lined to prevent leakage, with 30 cm soil placed over the liner to facilitate growth of aquatic vegetation.
- Rock beaching will be included around 30-40% of the constructed wetland margin and extend into the water; this will create warmer areas for basking and habitat for perching and shelter. Rocks stockpiled while clearing the site will be used where possible.
- Wetland planting will follow the criteria outlined in section 7.4.6. The species list will be in line with the Growling Grass Frog planting species list (Table 7). Four vegetation zones will be established within the wetlands:
  - Zone 1 – Terrestrial habitat. A mixture of tussock grasses and open, slashed areas of grasses and sedges with a sparse cover of trees and shrubs (suitable for foraging, sheltering and aiding in dispersal).
  - Zone 2 - (shallow marsh, soft edge) - amphibious tussock-forming grasses, herbs, rushes (suitable for basking, shelter, perching and male calling sites);
  - Zone 3 - Shallow inundation (marsh) amphibious and emergent aquatic herbs, grasses and sedges (suitable for basking, shelter, perching and male calling sites); and
  - Zone 4 - Permanent water (open water, submerged marsh, deep marsh); submergent and emergent aquatic herbs (e.g. e.g. water ribbons and pond weed). Required for egg-laying sites, protection of tadpoles and prey ambush sites. A high cover of pond weed (Potamageton spp.) has been found to be correlated with the abundance of Growling Grass Frogs in the Pakenham area (Hamer and Organ 2006).

- It is important to maintain open grassy areas which allow frogs to forage adjoining the waterbodies and allow movement and dispersal between the wetlands. These areas will be maintained as open areas with sedges, tussock-grasses (e.g. *Poa* spp.) and rocks. See the buffer design for further details.
- Wetland water will be drawn from a variety of sources including groundwater, piped rainfall and filtered creek water. See below for further details.

*Performance criteria*

- At least 30% of each wetlands supports shallow areas with emergent vegetation and at least 35% of each wetland supports deep areas with submergent vegetation
- Except for managed ephemeral wetlands, all wetlands will be permanent.
- Rock beaching is present along at 30%-40% of wetland perimeter.
- Wetlands and surrounding terrestrial appropriate vegetated with native plants.

*Potential corrective actions*

- Continue vegetation management following initial habitat construction (e.g. replace dead plants, increase planting density to increase cover, remove areas of emergent vegetation if emergent vegetation cover is too high) to ensure habitat on site is correct.
- Increase cover of rock beaching if required.
- Improve water delivery system if required (e.g. increase regularity of inspection/distribution).
- Increase the area of deep water in wetlands if submergent vegetation cover is too low.

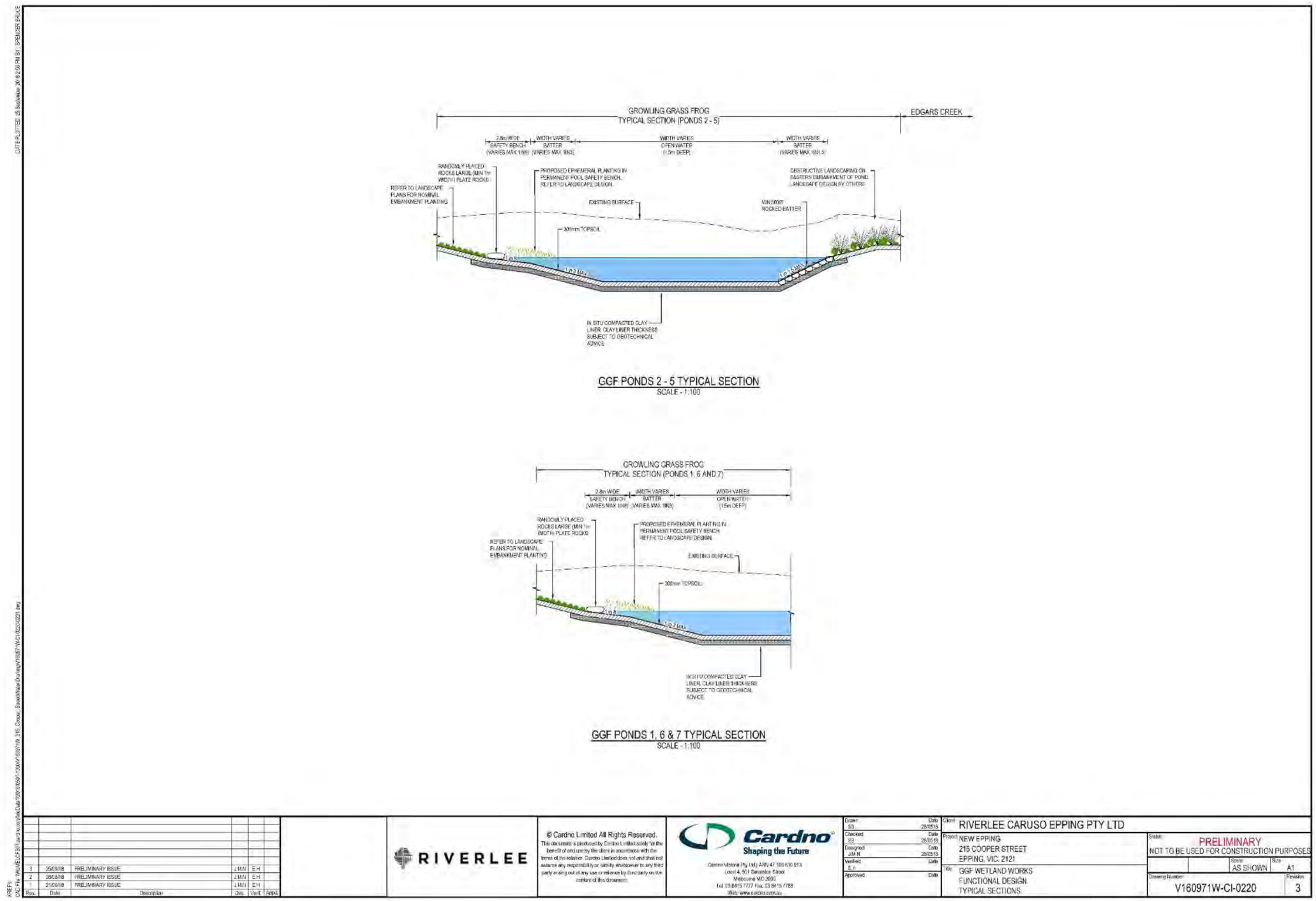



**Figure 10 Typical cross section of constructed off-channel Growling Grass Frog wetlands in the proposed habitat corridor.**

### Wetland buffer and terrestrial corridor design

The terrestrial environment surrounding the Growling Grass Frog wetlands will be dominated by open grassy areas that allow Growling Grass Frogs to forage and move to neighbouring water bodies. There will also be tussock grasses, sedges, rocks and logs to provide cover and perches. The terrestrial habitat will be split into two zones, a 10 m buffer around wetlands and the remainder of the terrestrial habitat corridor.

The management criteria outlined below largely meet the Growling Grass Frog Melbourne Strategic Assessment habitat standards (DELWP 2017b), however it falls short on two points. The design standards recommend a minimum habitat buffer around wetlands of 50 m from development (e.g. roads and buildings) and at least 30 m from shared use paths and minor infrastructure (e.g. passive recreation). The proposed design has minimum buffers around the wetlands of approximately 20 m to 40 m to development and 15 m to 30 m from minor infrastructure. As outlined in section 5.1.1, while the evidence suggests that a relatively wide terrestrial buffer is beneficial for the species, they are not essential for Growling Grass Frog persistence. For example while terrestrial buffers ≤ 100m either side of streams increases the risk of local extinction, the creation of good quality wetland habitat may significantly offset the loss of buffer (Heard and McCarthy 2012).

The buffer distances and terrestrial corridor design has been approved under EPBC 2016/7755.

*Management actions*

Construction and revegetation of the 10 m buffer zone around wetlands will adhere to the following design guidelines (DELWP 2017b):

- Approximately 45% cover of low complexity habitat such as mown grass, bare ground and rocks for foraging and basking.
- Roughly 45% cover of high complexity habitat such as dense tussock grasses, sedges and rushes
- Around 10% cover of rocks and logs for overwintering habitat. Rocks and logs stockpiled while remediating the creekline will be used where possible.
- No shrubs or trees will be planted in this buffer zone.
- Mowing will be limited in frequency within 10 m of created/retained wetlands to reduce the risk of mortality to Growling Grass Frogs.
- Mowing/slashing within 10m of wetlands will be conducted over winter to reduce risk of mortality to Growling Grass Frogs.
- Plant species used in revegetation will be indigenous to the local area and will follow those outlined in section 7.4.6.

The remaining terrestrial habitat corridor will meet the following design criteria:

- Roughly 50-80% of the corridor will consist of mown grass with 20-50% of cover being dominated by tussock grasses and sedges.
- The cover of trees and woody plants >2 m tall will not exceed more than 10% to reduce shade.

- Plant species used in revegetation will be indigenous to the local area and will follow those outlined in section 7.4.6.
- Road bridge abutments will be constructed during the habitat corridor construction phase to minimise the effect on the habitat corridor during the construction phase.
- Construction work on the bridges and storm water infrastructure will minimise their footprint as much as possible to reduce damage to Growling Grass Frog habitat. Any damage to the habitat corridor will be properly rehabilitated.

*Performance criteria*

- Terrestrial habitat supports areas of open, low complexity vegetation (e.g. mown lawn) and low, dense, complex vegetation (tussock grasses and sedges), as well as logs and rocks.
- Few trees or shrubs are planted in the habitat corridor.
- Vegetation properly maintained and managed.
- Any works in the habitat corridor have a small footprint and any damage is properly rehabilitated.

*Potential corrective actions*

- Increase rate of ongoing management of vegetation (e.g. increased slashing of open areas, replacing dead plants, controlling weeds).
- Remove shrubs or trees if shading is too great.

### Wetland water management

Permanent water over the Growling Grass Frog breeding season (September-February) reduces the probability of extinction of a Growling Grass Frog population (Heard *et al.* 2010). Accordingly, Growling Grass Frog habitat design standards (DELWP 2017b) require 75% of wetlands in a cluster to be permanent, or as close to permanent as practicable. All off channel wetlands (excluding managed ephemeral wetlands) in the habitat corridor will be permanent.

In order to maintain permanent wetlands, a water delivery system will be constructed to maintain water levels in the wetlands (see Figure 11 for an example system). ~~The system will use a combination of water sources (primarily quarry water and potable water, but potentially stormwater and rooftop rainwater as the project develops) to manage salinity in the constructed wetlands.~~ The primary water source for the wetland system will be the slightly saline water from the quarry pit. The specifics of the water delivery system are to be finalised, however the system will allow each wetland to be:

Refer to update #45

- Filled with the slightly saline water from the main quarry water body.
- Filled with freshwater (e.g. potable water, treated stormwater, rooftop rainwater, ) to reduce salinity.
- Fully drained if predatory fish are recorded in the wetlands.

Refer to update #46

~~Ponds will be managed at two salinity levels, as frogs from more saline waterbodies tend to have a lower chytrid load(Stockwell *et al.* 2015) . Ponds 2, 4 and 7 will be managed as brackish wetlands (<7000 µS/cm) and ponds 1, 3, 5 and 6 as freshwater wetlands (<3,000 µS/cm).~~ Ephemeral wetlands will be fed primarily with freshwater, as regular drying out will increase salinity. Water levels will be actively

maintained, and over the breeding season (October to March) water levels will be checked monthly. Depth gauges will be installed in all ponds. If water levels are shown to be relatively stable over cooler months (April-September), water levels could be checked every two months.

As salinity is expected to increase in wetlands due to evaporation, salinity will need to be tested twice annually in each wetland, once in spring and again in autumn. If salinity exceeds 7,000 µS/cm, freshwater will need to be pumped into the wetlands to reduce salinity, and potentially drained and refilled if very saline. Wetlands will be designed to drain to a single deep point where all water can be extracted from.

In addition, ponds will be clay lined to reduce leakage.

*Management actions*

- Ensure constructed wetlands are kept permanent by constructing a water distribution network.
- Construct a water distribution network that enables all wetlands to be filled with both slightly saline water from the main quarry waterbody and freshwater.
- Monitor and manage water levels monthly.
- Install depth gauges at all wetlands.
- Monitor salinity at the end of spring and autumn to ensure that salinity is not above 7,000 µS in any of the wetlands. If salinity exceeds 7,000 µS, reduce salinity by pumping in freshwater or draining and refilling the wetland(s).

*Performance criteria*

- Wetlands are permanent, and water depths are not allowed to drop below 50 cm at any time.
- A range of salinities are maintained at wetlands across the site, and the salinity of wetlands is not allowed to exceed 7,000 µS.

*Potential corrective actions*

- Ensure water delivery system is functioning properly.
- More regular wetland water level inspection and management, particularly over summer and dry periods.
- More regular monitoring of salinity in wetlands.
- Reduce the salinity of wetland water sources by shandying up holding tank further and/or exploring additional freshwater sources (e.g. increase amount of storm water and/or roof runoff sources).

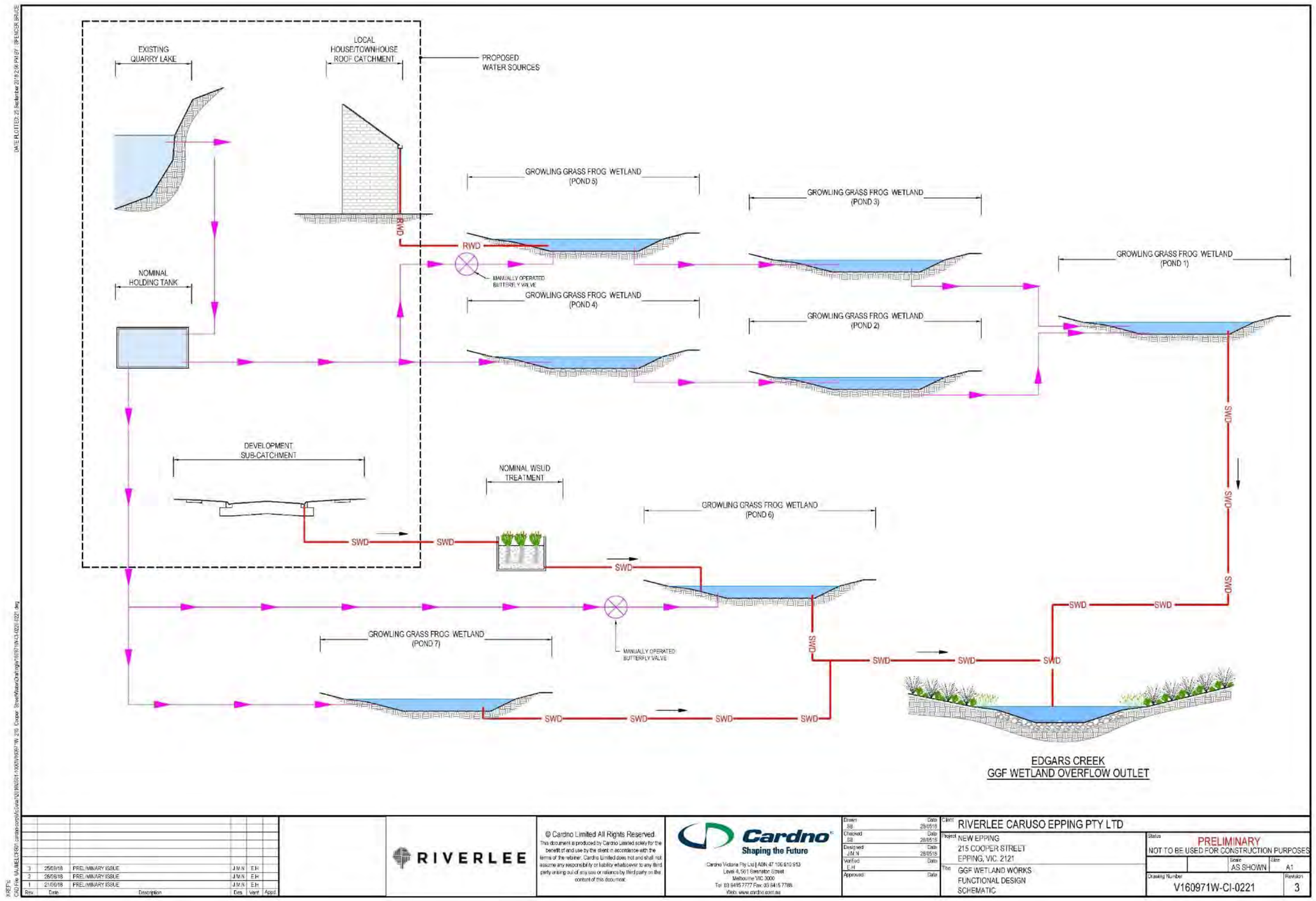



**Figure 11 Indicative water delivery system for maintaining water levels in off-channel wetlands. Final design for the system is to be confirmed, however each wetland will be connected to groundwater and freshwater sources.**

### Wetland water quality

Water quality tolerances and preferences for Growling Grass Frogs are poorly known (DELWP 2017b), however, recent studies have revealed that, whilst frogs are likely to tolerate a range of water conditions (Ashworth 1998; Pyke 2002; Hamer *et al.* 2002), frogs generally prefer water bodies possessing low levels of nutrients and salinity levels for successful breeding and recruitment to occur (Ashworth 1998; Organ 2002, 2003, 2005; Hamer and Organ 2006). As such, the water quality of Edgars Creek and its associated wetlands will need to be maintained within the ranges known at sites occupied by the Growling Grass Frog. However, moderate levels of salinity (up to 7000 µS/cm) are regularly recorded in existing breeding wetlands on site due to relatively saline groundwater in the region. Growling Grass Frogs have been recorded inhabiting wetlands with conductivities of up to 15,100 µS/cm at 215 Cooper St, Epping (Ecology Australia 2019a). Moderately elevated salinities may be beneficial to Growling Grass Frogs due to suppression of Chytrid. As a result, a variety of salinities will be maintained on site (see below).

*Management actions*

- Install sediment control devices during construction along the length of the habitat corridor.
- Install sediment traps at storm water drain exits.
- Gross pollutant traps will be required if flows from future development enter the wetland reserves.
- Best management practices will be implemented through erosion and sediment control fencing/traps during construction around waterways.
  - Sediment control must be in accordance with “Construction Techniques for Sediment Control” (EPA Victoria 1991) and “Environmental Guidelines for Major Construction Sites” (EPA Victoria 1996).
- ~~A variety of salinities will be managed in the constructed wetlands on site, these will be maintained by utilising a variety of water sources for the wetlands. Specifically wetlands will be maintained at:~~
  - ~~Lower salinity (<3,000 µS/cm, wetlands P1, P3, P5 and P6) using a combination of groundwater and freshwater.~~
  - ~~Lower salinity (wetlands E1, E2, E3, <3,000 µS/cm when full). As ephemeral wetlands will increase in salinity over time due to regular drying out, groundwater use will be minimal.~~
  - ~~Higher salinity (<7,000 µS/cm) using primarily groundwater (wetlands P2, P4 and P7).~~

Refer to update #47

- The source of water for the constructed wetlands will be from rain, groundwater, surface run-off, stormwater run-off and roof run off from future development. Therefore, water quality monitoring will be crucial in ensuring conditions are suitable for the Growling Grass Frog.
- Monitor salinity to ensure that salinity is not above 3, 000 µS/cm or 7,000 µS in any of the wetlands. If salinity exceeds 3, 000 µS/cm or 7,000 µS, reduce salinity by pumping in freshwater or draining and refilling the wetland(s). Basic water quality (I.e. salinity, conductivity, temperature, dissolved oxygen, turbidity, and pH) will be monitored monthly for two years, and then reassessed.

- Additional water quality monitoring will be conducted twice annually (spring and autumn) to determine concentrations of metals, fertilisers, herbicides, hydrocarbons and *E. coli* bacteria.
- The use of herbicides and fertilisers will be avoided where practicable in areas adjacent to Edgars Creek and the wetland reserves and to reduce the potential for non-target impacts, the source of nutrient enrichment and the likelihood of algal blooms.
- While mechanical (hand) removal of weeds is preferred, many of the weed species requiring control will require herbicide application (see Section 7.4.7). Herbicides which are commonly applied around aquatic environments will be used (e.g. Roundup Bi-active) and sponging or wicking directly onto weeds rather than spraying is preferred.
- Sampling programs will follow Environment Protection Agency guidelines. If monitoring detects harmful levels of particular water quality attributes, remedial action will be undertaken in consultation with EPA, DELWP and Council.

*Performance criteria*

- Known water quality parameters do not exceed those outlined in Table 6.
- Concentrations of other parameters (e.g. dissolved oxygen, chlorine, hydrocarbons, pesticides) should be low (95% species protection under Commonwealth of Australia (2018) guidelines).
- Sediment control fencing installed along edge of habitat corridor during construction of residential and industrial areas.
- Wetlands managed at varying salinities.
- Stormwater treated with a treatment pond prior to entering Growling Grass Frog wetlands.

*Potential corrective actions*

- Drain wetland(s) if water becomes too saline or other water quality parameters become too poor.
- Improve sediment and pollution control in construction areas.
- Explore additional water sources for wetlands if water quality is an ongoing issue (e.g. more rooftop and/or stormwater runoff)

**~~Table 6~~ ~~Maximum values for water quality parameters in Growling Grass Frog wetlands, taken from DELWP (2017b).~~**

Refer to update #48

| Water Quality Parameter | Target Value |
|---|---|
| Total Nitrogen (mg/L) | < 1.0 |
| Ammonia (mg/L) | < 0.01 as NH4+ |
| Total phosphorous (mg/L) | < 0.1 |
| pH | 6.0-9.0 (adapted with information from Ecology Australia 2017b) |
| E.coli (organisms/100 ml) | Primary Contact < 150<br>Secondary contact < 1000 |
| Salinity (µS/cm) | <3000 for low salinity or <7000 for high salinity wetlands – |

| Water Quality Parameter | Target Value |
|---|---|
| | Growling Grass Frog recorded breeding in salinities this high on site |
| Turbidity (NTUs) | < 40 |

### 7.4.6 Revegetation

Revegetation will be required along Edgars Creek (excluding the northern section of the creek recently revegetated by Melbourne Water), at the constructed and existing wetlands and the surrounding terrestrial habitat within the habitat corridor. To ensure satisfactory habitat for Growling Grass Frogs is established the structure of plantings will be such that the wetland reserves do not become 'choked' with overly dense stands of vegetation, nor are the banks shaded out by over-hanging vegetation. The aim of revegetation is to provide a structurally diverse understorey, while retaining areas of open water and open foraging habitat. While two indigenous shrub species (Woolly Tea-tree *Leptospermum lanigerum* and Tangled Lignum *Muehlenbeckia florulenta*) are recommended for use in wetland revegetation (Table 7), the overall cover of these species must be kept low.

Revegetation will be split into four different zones ranging from terrestrial habitats to the deeper, permanent sections of wetlands. The zones are as follows:

- Zone 1: Terrestrial habitat in the habitat corridor. Terrestrial habitat will be further split into two sub zones:
  - Within 10 m of wetlands, habitat will be more complex, and include approximately 45% cover of high complexity habitat such as tussock grasses, sedges and rushes, 45% cover of low complexity habitat including mown grass and bare ground and 10% cover of rocks and logs. No trees or shrubs >2 m tall will be planted in this zone.
  - More than 10 m from wetlands, mown grass will make up the majority (50% - 80%) of habitat with the remainder comprising tussock grasses and sedges. Cover of trees and shrubs will be <10% in this area.
- Zone 2: Permanently moist or seasonally wet margins; shallow seasonal inundation in lower part of zone.
- Zone 3: Shallow inundation; upper minimum depth of inundation c. 10 cm; amphibious and emergent aquatic herbs, some straddling Zones 2 and 3.
- Zone 4: Permanent water; submergent and emergent aquatic-herbs, some straddling Zones 3 and 4.

Indigenous plant species suitable for revegetation at the New Epping development are given below in Table 7. The species and zones indicated here are modelled on natural wetland vegetation that occurs along streams and off-stream wetlands on basalt-derived soils locally and regionally.

#### Planting zones for wetlands and terrestrial habitat.

Terrestrial habitat corridor (Zone 1) will be dominated by a mixture of open mown grassy areas and denser patches of tussock grasses similar to those outlined in Zone 2. Terrestrial habitat will be split into two sub-zones. Within 10 m of wetlands, habitat will be more complex, and include approximately 45%

cover of high complexity habitat such as tussock grasses, sedges and rushes, 45% cover of low complexity habitat including mown grass and bare ground and 10% cover of rocks and logs. No trees or shrubs >2 m tall will be planted in this zone. More than 10 m from wetlands, mown grass will make up the majority (50% - 80%) of habitat with the remainder comprising tussock grasses and sedges. Cover of trees and shrubs will be <10% in this area.

Fringing vegetation (Zone 2) will be densely planted with tussock-forming or rhizomatous perennials. The inter-tussock spaces will be vegetated with a sward of rhizomatous, stoloniferous or tufted perennials. Some species will also be dominants or co-dominants of the vegetation in Zone 3, thus are likely to form continuous swards straddling both zones. The primary objective in Zone 2 is to achieve a closed cover of vegetation as quickly as possible after planting to stabilise banks (thus preventing erosion, particularly by wave action) and to exclude weeds.

Shallow areas (Zone 3) may be vegetatively structurally diverse but the aim is to produce a dense cover to stabilise the substrate and prevent colonisation by weeds, particularly during the summer drawdown of the water. All species selected are emergent aquatic plants or amphibious species able to cope with exposure during draw-down. Several species are winter-deciduous because of low temperatures (e.g. *Bolboschoenus caldwellii*), or may be summer-dormant (e.g. *Eleocharis acuta*) when receding water levels impose drought stress. In each case the aerial parts die back to storage organs (rhizomes, tubers etc). Dormant plants resume growth in spring and summer respectively.

Deep water (Zone 4) will be dominated by submerged aquatic species of permanent water. These are rhizomatous or stoloniferous perennials which are intended to densely cover the substrate.

### Revegetation methods

The planting of tubestock is considered the only viable option for revegetation within the study area, as massive competition from weeds will make other methods, such as direct seeding or the facilitation of natural recruitment, ineffective

### Revegetation strategy

The process of successful revegetation requires planning, documentation, implementation, monitoring and maintenance;

- Site selection: should include consideration of the following issues:
  - Existing indigenous flora – ensure revegetation activities do not negatively impact existing indigenous vegetation.
  - Weed flora – ensure sufficient weed control has been undertaken pre-planting.
- Site preparation: will be variously required throughout the study area and will include:
  - Weed control.
  - Tree-guarding and fencing (only recommended if grazing pressures are found to significantly increase mortality of plants). This includes ‘netting’ of wetland plantings.
  - Jute matting.
- Species selection: plantings must make ecological sense, i.e. species ‘belong’ in particular environments and plant species associations.

- Sources of propagating material: all revegetation will utilise indigenous species propagated from material (seeds, cuttings, divisions) which must be obtained from the nearest natural populations, with the appropriate DELWP permits and protocols to avoid harm to the source populations by overexploitation. All sources of material will be recorded by the contractor(s) or other parties involved in revegetation. Planted populations are unfortunately often unreliable as sources of material because much non-indigenous material is used in some sectors of the revegetation industry. All plants and propagation material must be correctly identified and named before being utilised in revegetation.
- Propagation of production plants: must be undertaken with sufficient lead time to achieve good growth by the time of planting. This will require that the contractor has been allocated sufficient time to undertake collection and growing-on of the tubestock before the projected planting time. Conversely, over-grown or root-bound tubestock (depending upon the species involved) will be rejected.
- Documentation: by documenting the various components of a revegetation program (e.g. locations and dates of seed collection, provenance of revegetated plants used at a particular site, weed control, monitoring, etc.) the success rates of future revegetation can be increased as a greater understanding of 'what works' is achieved and communicated to future practitioners.
- Planting: autumn to spring planting of terrestrial species and spring planting of wetland species is recommended for the study area, allowing for optimal growing conditions (moisture availability and increasing soil temperature). Terrestrial plantings will be watered at the time of planting (to reduce air pockets around the root zone), though follow-up watering should not be necessary. Wetland plantings will be 'netted' if over-grazing by waterfowl is observed.
- Monitoring: is of utmost importance that all revegetation be monitored. Effectively timed monitoring will allow various degradation processes (weeds, grazing) to be managed before they adversely affect the plantings.
- Maintenance: timing will coincide with ecological timelines (e.g. undertake weed control before seed-set) and always seek to optimise the health of the plants used in the revegetation. All plant losses will be replaced unless mortality has been the result of unmanageable site conditions (e.g. prolonged drought).

### Management Actions

- Contract revegetation specialists to implement revegetation. The contractor must be suitably qualified to undertake revegetation/rehabilitation works as outlined in this document.
- Undertake propagation of tubestock/cells in accordance with information provided above.
- Undertake revegetation works as outlined above and in Table 7.
- Implement a revegetation monitoring program, and ensure all plant losses are replaced.
- Ensure all revegetation activities are undertaken with reference to Growling Grass Frog requirements outlined in section 7.4.5 (e.g. maintain a mosaic of vegetation structure so as not to overshade sections of creek/wetlands and to provide shelter and refuge habitat).

### Performance criteria

- Habitat corridor adequately revegetated with species outlined in Table 7.
- Habitat created matches habitat requirements of Growling Grass Frog (Section 7.4.5, DELWP 2017b).
- Revegetation maintained to replace dead plants and remove weeds.

### Potential corrective action

- Increase vegetation monitoring to replace dead plants, increase cover of vegetation and control weeds.
- Remove some emergent vegetation if wetlands become clogged with emergent vegetation.
- Remove and replace inappropriate vegetation.

**Table 7 Plant species suitable for use in habitat corridor revegetation**

**Vegetation Zones**

**Zone 1** Terrestrial habitat in the habitat corridor. No trees and shrubs will be planted within 10 m of wetlands and cover of trees and shrubs elsewhere will not exceed 10%

**Zone 2** Permanently moist or seasonally wet margins; shallow seasonal inundation in lower part of zone.

**Zone 3** Shallow inundation; upper minimum depth of inundation c. 10 cm; amphibious and emergent aquatic herbs, some straddling Zones 2 and 3.

**Zone 4** Permanent water; submergent and emergent aquatic-herbs, some straddling Zones 3 and 4.

Highlighting for each species in each zone is indicative of their dominance in that zone. Species highlighted with dark grey should be the dominant species in that zone, those highlighted in light grey should be common, and those not highlighted should be scattered. Where plant species are not available, other species may be substituted in consultation with a suitably qualified ecologist.

| Species | Common Name | Vegetation zone | | | | Notes |
|---|---|---|---|---|---|---|
| | | Zone 1 | Zone 2 | Zone 3 | Zone 4 | |
| **Trees** | | | | | | |
| *Acacia implexa* | Lightwood | ✓ | | | | |
| *Acacia mearnsii* | Late Black Wattle | ✓ | | | | |
| *Acacia pycnantha* | Golden Wattle | ✓ | | | | |
| *Allocasuarian verticillata* | Drooping Sheaok | ✓ | | | | |
| *Eucalyptus camaldulensis* | River Red-gum | ✓ | | | | |
| **Large and Medium shrubs** | | | | | | |
| *Acacia acinacea* | Gold Dust Wattle | ✓ | | | | |
| *Acacia paradoxa* | Hedge Wattle | ✓ | | | | |
| *Bursaria spinosa ssp. spinosa* | Sweet Bursaria | ✓ | | | | |
| *Correa glabra var. glabra* | Rock Correa | ✓ | | | | |
| *Dodonaea viscosa ssp. spatulata* | Sticky Hop-bush | ✓ | | | | |
| *Eremophila deserti* | Turkey Bush | ✓ | | | | |
| *Goodenia ovata* | Hop Goodenia | ✓ | | | | |
| *Grevillea rosmarinifolia ssp. rosmarinifolia* | Rosemary Grevillea | ✓ | | | | |
| *Leptospermum lanigerum* | Woolly Tea-tree | ✓ | ✓ | | | |
| *Melicytus dentatus* | Tree Violet | ✓ | | | | |
| *Myoporum petiolaturm* | Sticky Boobialla | ✓ | | | | |
| *Muehlenbeckia florulenta* | Tangled Lignum | ✓ | ✓ | | | |
| *Olearia ramulosa var. ramulosa* | Twiggy Daisy-bush | ✓ | | | | |
| **Perennial herbs** | | | | | | |
| *Alisma plantago-aquatica* | Hairy Willow-herb | | | ✓ | | |
| *Alternanthera denticulata* | Lesser Joyweed | | ✓ | | | |
| *Calystegia sepium subsp. roseata* | Large Bindweed | | ✓ | | | |
| *Centella cordifolia* | Centella | | ✓ | | | |
| *Crassula helmsii* | Swamp Crassula | | ✓ | | | |
| *Cycnogeton procerum* s.l. (broad erect leaves) | Water-ribbons | | ✓ | ✓ | | |
| *Epilobium billardierianum subsp. billardierianum* | Smooth Willow-herb | | ✓ | | | |
| *Epilobium hirtigerum* | Hairy Willow-herb | | ✓ | | | |
| *Hydrocotyle sibthorpioides* | Shining Pennywort | | ✓ | | | |
| *Lilaeopsis polyantha* | Australian Lilaeopsis | | ✓ | ✓ | | |
| *Lobelia pratioides* | Poison Lobelia | | ✓ | | | |
| *Lythrum salicaria* | Purple Loosestrife | | ✓ | | | |
| *Marsilea drummondii* | Common Nardoo | | ✓ | ✓ | | If submerged plant only in shallow water (<30 cm deep) |
| *Myriophyllum crispatum* | Upright Water-milfoil | | | | ✓ | |
| *Myriophyllum verrucosum* | Red Water-milfoil | | | | ✓ | |
| *Ottelia ovalifolia subsp. ovalifolia* | Swamp Lily | | | | ✓ | |
| *Persicaria decipiens* | Slender Knotweed | | ✓ | ✓ | | |
| *Persicaria prostrata* | Creeping Knotweed | | ✓ | | | |

| Species | Common Name | Vegetation zone | | | | Notes |
|---|---|---|---|---|---|---|
| | | Zone 1 | Zone 2 | Zone 3 | Zone 4 | |
| *Potamogeton cheesemanii* | Red Pondweed | | | ✓ | | |
| *Potamogeton ochreatus* | Blunt Pondweed | | | ✓ | ✓ | |
| *Ranunculus inundatus* | River Buttercup | | ✓ | ✓ | | |
| *Selliera radicans* | Shiny Swamp-mat | | ✓ | | | |
| *Stuckenia pectinata* | Fennel Pondweed | | | | ✓ | |
| *Triglochin striatum* (robust form) | Streaked Arrow-grass | | ✓ | | | |
| *Vallisneria australis* | Eel Grass | | | | ✓ | |
| *Ornduffia reniformis* | Running Marsh-flower | | ✓ | ✓ | | |
| **Grasses and graminoids** | | | | | | |
| *Amphibromus fluitans* | River Swamp Wallaby-grass | | | ✓ | | |
| *Amphibromus nervosus* | Common Swamp Wallaby-grass | ✓ | ✓ | | | |
| *Austrostipa bigeniculata* | Kneed spear-grass | ✓ | | | | |
| *Baumea articulata* | Jointed Twig-sedge | | | ✓ | | |
| *Baumea juncea* | Bare Twig-sedge | ✓ | | | | |
| *Bolboschoenus caldwellii* | Salt Club-sedge | | ✓ | ✓ | | |
| *Bolboschoenus medianus* | River Club-sedge | | ✓ | ✓ | | |
| *Carex bichenoviana* | Plains Sedge | ✓ | ✓ | | | |
| *Carex tereticaulis* | Poong'ort | ✓ | ✓ | | | |
| *Eleocharis acuta* | Common Spike-rush | | ✓ | ✓ | | |
| *Eleocharis sphacelata* | Tall Spike-sedge | | ✓ | ✓ | | |
| *Glyceria australis* | Australian Sweet-grass | | ✓ | | | |
| *Juncus amabilis* | Hollow Rush | | ✓ | | | |
| *Juncus flavidus* | Gold Rush | | ✓ | | | |
| *Juncus semisolidus* | Plains Rush | | ✓ | | | |
| *Juncus usitatus* | Common Rush | ✓ | | | | |
| *Lachnagrostis filiformis var. 1* | Common Blown-grass | | ✓ | | | |
| *Poa labillardierei var. labillardierei* | Common Tussock-grass | ✓ | ✓ | | | |
| *Schoenoplectus pungens* | Sharp Club-sedge | | | ✓ | | |
| *Schoenoplectus tabernaemontani* | River Club-sedge | | | ✓ | | |
| *Themeda triandra* | Kangaroo Grass | ✓ | | | | |

### 7.4.7 Weed management

Weed species listed for control or elimination in Table 8 have been identified based on their likelihood of occurrence in the immediate vicinity of the Creek within the study area. These are a small proportion of the weed flora, but are species/populations that must be managed because of their seriousness as invaders, and/or are required to be managed under the *Catchment and Land Protection Act* 1994 (CaLP Act) for the Port Phillip and Westernport CMA region or as a Weed of National Significance (WONS). Other species will require management in certain circumstances (e.g. to allow for revegetation), but full-scale management would be untenable.

Weed flora is not static, and new weed species are likely to appear within the study area over the duration of this management plan, introduced by a wide range of natural agents (e.g. wind and animals). The weeds listed for control in Table 8 is not exhaustive. Annual monitoring will allow for the identification of new weed species and their incorporation into the management program as appropriate.

Weed management operators must be suitably qualified and appropriately certified and possess the requisite weed and indigenous plant identification skills. Additionally, all aspects of the control program need to be appropriately documented (to an agreed standard) to enable the tracking and evaluation of control methods/activities, and to allow for refinement of procedures, as well as to inform future weed management activities. Finally, damage to indigenous vegetation (by herbicide or machinery and to soils) must be avoided at all times, and all health and safety, and environmental regulations, must be observed.

Use of herbicides will be kept to a minimum and where possible weeds will be removed using physical treatments (e.g. physically removed, cutting or ringbarking). All herbicide usage within the study area will be in accordance with the following:

- The use of herbicides in and adjacent to water-bodies (including riparian zones and wetlands) will be avoided where practicable. If unavoidable, herbicides only legally certified for use in such situations (as specified on the product label) will be used. Application methods resulting in low levels of off-target damage (e.g. 'wick wiping', cut/paint, and drill/fill) will be favoured over spray application.
- Where possible, undertake herbicide application during periods of low water.
- All use of herbicides (and associated additives) will be in accordance with the product label. Off-label use of herbicides may be permitted where approval has been granted from a state government department (e.g. DELWP or Department of Economic Development, Jobs, Transport and Resources).
- Site-specific herbicide planning (application methods, chemicals used, weather conditions, plant phenology, etc.) will be employed to reduce off-target herbicide damage. Off-target herbicide damage is the detrimental application of herbicide to plant species that have not been targeted for control. While this generally applies to plants in and around the point of herbicide application, it may also refer to organisms (flora and fauna) some distance away.
- Seasonal restriction: If Growling Grass Frogs are likely to be present in areas requiring control, herbicide spraying must not be undertaken within the wetlands during the Growling Grass Frog breeding season (October – March); however 'wick-wiping' (the direct application of

herbicide to foliage via a wick/sponge) may be undertaken during this period. This also corresponds with the Golden Sun Moth flight period, where herbicide spraying is not recommended (November to early January).

### Management Actions

- Contract weed management specialists to implement weed control as outlined above. The contractor must be suitably qualified to undertake weed management works as outlined in this document.
- Implement an annual monitoring program to ensure weed control works are successful, and to identify areas for ongoing works.

### Performance criteria

- Targeted weeds are controlled when encountered and do not establish infestations in the habitat corridor.
- Targeted weed list updated annually at a minimum to address new weeds.
- Herbicide concentrations are not elevated in wetlands during water quality monitoring.

### Potential corrective action

- Increase rate of weed inspections and control
- Update targeted species list to include new threats as they emerge.

## Table 8 Weed species requiring control or elimination

**Life form** (mostly after Carr *et al.* 1992)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A | annual | Gt | tuberous geophyte | Pt | perennial herb (tussock forming) | T | tree |
| B | biennial | Ls | large shrub | S | small to medium shrub | | |

**Noxious weed / WONS**

WONS – Weed of National Significance (www.weeds.org.au)

C – listed as a Controlled weed species under the *Catchment and Land Protection Act 1994* for the Port Phillip and Westernport Catchment Management Authority region

R -listed as a Regionally Controlled weed species under the *Catchment and Land Protection Act 1994* for the Port Phillip and Westernport Catchment Management Authority region

**Control method(s) (relevant to population size and distribution of species within the study area)**

**A Herbicide treatments**

1 Herbicide applied to foliage with spray, wick applicator, etc.; annuals must be sprayed well before seed ripening.

2 Cut down and concentrated herbicide immediately applied to stump or stems, or bark "frilled" and herbicide applied.

3 Stem drilled and injected with concentrated herbicide.

**B Physical treatments**

4 Physical removal – most plants can be physically removed by hand-weeding or with tools when small and/or isolated but soil disturbance is kept to a minimum.

5 Cut off at ground level (species that will not resprout from basal buds).

6 physical removal – 'scraping' or 'scalping' plants using machinery (e.g. backhoe or bulldozer) ensuring any plant material capable of regeneration is removed.

**Control or eliminate**

E eliminate all plants/populations within the property

C control weed populations (elimination from property considered unfeasible)

| Species | Common Name | Family | Life form | Listed Species | | Control/Eliminate | Control methods |
|---|---|---|---|---|---|---|---|
| | | | | WONS | CALP | | |
| *Acacia floribunda* | White Sallow-wattle | Mimosaceae | Ls/T | | | E | 2 (young), 5 (old) |
| *Asparagus asparagoides* | Bridal Creeper | Asparagaceae | Gt | ✓ | R | E | 1 |
| *Carduus pycnocephalus* | Slender Thistle | Asteraceae | A | | C | C | 1 |
| *Carthamus lanatus* | Saffron Thistle | Asteraceae | A | | C | C | 1 |
| *Chamaecytisus palmensis* | Tree Lucerne | Fabaceae | Ls | | | E | 1,2 |
| *Chrysanthemoides monilifera ssp. monilifera* | Boneseed | Asteraceae | Ls | ✓ | C | E | 2,4 |
| *Cirsium vulgare* | Spear Thistle | Asteraceae | B | | C | C | 1,4 |
| *Cotoneaster pannosus* | Velvet Cotoneaster | Rosaceae | Ls | | | E | 2 |
| *Crataegus monogyna* | Hawthorn | Rosaceae | Ls/T | | C | E | 1,2,3 |
| *Cynara cardunculus* | Spanish Artichoke | Asteraceae | Pt | | C | C | 1 |
| *Dipsacus fullonum subsp. fullonum* | Wild Teasel | Dipsacaceae | B | | C | C | 1 |
| *Echium plantagineum* | Paterson's Curse | Boraginaceae | A | | C | C | 1 |
| *Foeniculum vulgare* | Fennel | Apiaceae | Pt | | R | C | 1,2 |
| *Fraxinus angustifolia* ssp. *angustifolia* | Desert Ash | Oleaceae | T | | | E | 2 |
| *Genista monspessulana* | Montpellier Broom | Fabaceae | Ls | | C | C | 1,2,4 |
| *Juncus acutus* ssp. *acutus* | Sharp Rush | Juncaceae | Pt | | C | E | 1,6 |
| *Lycium ferocissimum* | African Box-thorn | Solanaceae | Ls | | C | E | 1,2 |
| *Malus pumila* | Apple | Rosaceae | T | | | E | 2 |
| *Melaleuca styphelioides var. styphelioides* | Prickly Paperbark | Myrtaceae | Ls/T | | | E | 2 |
| *Nassella charruana* | Lobed Needle-grass | Poaceae | Pt | | S | E | 1 |
| *Nassella neesiana* | Chilean Needle-grass | Poaceae | Pt | ✓ | R | C | 1 |

| Species | Common Name | Family | Life form | Listed Species | | Control/Eliminate | Control methods |
|---|---|---|---|---|---|---|---|
| | | | | WONS | CALP | | |
| *Nassella trichotoma* | Serrated Tussock | Poaceae | Pt | ✓ | C | C | 1 |
| *Olea europaea ssp. europaea* | Olive | Oleaceae | T | | | E | 2 |
| *Paraserianthes lophantha subsp. lophantha* | Cape Wattle | Mimosaceae | Ls/T | | | E | 2 |
| *Phalaris aquatica* | Phalaris | Poaceae | Pt | | | C | 1 |
| *Prunus cerasifera* | Cherry Plum | Rosaceae | T | | | E | 2 |
| *Rosa rubiginosa* | Sweet Briar | Rosaceae | Ls | | C | C | 1,2 |
| *Rubus anglocandicans* | Blackberry | Rosaceae | Ls | ✓ | C | E | 1,2 |
| *Salix X sepulcralis var. sepulcralis* | Willow | Salicaceae | T | ✓ | R | E | 2,3 |
| *Schinus molle* | Pepper Tree | Anacardiaceae | T | | | E | 2,3 |
| *Silybum marianum* | Variegated Thistle | Asteraceae | A | | C | C | 1 |
| *Solanum linnaeanum* | Apple of Sodom | Solanaceae | S | | C | E | 2 |
| *Ulex europaeus* | Gorse | Fabaceae | Ls | ✓ | C | C | 1,2 |
| *Xanthium spinosum* | Bathurst Burr | Asteraceae | A | | C | C | 1 |

### 7.4.8 Frog migration phase

Following the establishment of the habitat corridor, Growling Grass Frogs will be given a two breeding season long migration phase (early 2020 to mid 2022). This migration phase is intended to allow Growling Grass Frogs to naturally migrate from existing habitat to the newly established habitats on site. During this time, current habitat and the newly established habitat corridor will be no-go zones, except for contractors maintaining revegetation in the habitat corridor and monitoring wetlands and Growling Grass Frog populations. Growling Grass Frog populations in the new wetlands will be monitored to ensure that breeding populations have established in the constructed wetlands. If breeding colonies are not established after two years, adaptive management will be implemented (Section 7.4.9).

#### Management actions

- Extend the established "no-go" zone (Section 7.4.2) to include the revegetated habitat corridor and remove fencing separating existing habitat from the habitat corridor (Figure 12).
- Protect existing wetlands and newly established habitat corridor with fencing (Figure 12), and install sediment and pollution control measures where applicable.
- Place signage along the fence to demonstrate to contractors that the area is a 'no-go zone' for the duration of the frog migration period.
- No dumping of soil or other materials in the no-go zone.
- Discuss the no-go zones during site inductions.
- Establish frog fencing (see section 7.4.14) on the eastern edge of the habitat corridor to prevent frogs entering construction zones.
- No construction in the Green Quarter during the migration period.
- Access to the no go zones will be restricted to contractors:
  - Monitoring revegetation, replacing lost plants and removing weeds.
  - Mowing grassy areas in the terrestrial habitat.
  - Monitoring wetland water quality and water levels.
  - Monitoring Growling Grass Frog populations.
- Access kept to a minimum during Growling Grass Frog breeding season.
- Growling Grass Frog populations will be monitored twice per breeding season (See section 7.4.17)
- Consider novel actions such as Growling Grass Frog call playback at constructed wetlands to attract Growling Grass Frogs. Evidence suggests that some species may be attracted to wetlands where other frogs are calling, however this has not been tested for Growling Grass Frogs (Buxton *et al.* 2015).

#### Performance criteria

- Exclusion and frog fencing with "no-go area" signage established around habitat corridor.
- No construction activity in habitat corridor during migration phase

- Growling Grass Frog migration phase must meet the following criteria to be successful:
  - Continue for two full breeding seasons after the practical completion of the Growling Grass Frog habitat corridor (i.e. not prior to mid-2021). If the construction and revegetation of the habitat corridor is delayed beyond September 2020, the construction west of the habitat corridor must be postponed to allow for this designated migration period;
  - Successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season; this is informed by the assumptions of modelling occupancy at the site (Ecology Australia 2016b), as well successful breeding having been recorded in two or more of the existing wetlands in both previous surveys (Wildlife Profiles 2015; Ecology Australia 2017a)
  - Growling Grass Frogs recorded in at least 50% (i.e. four of seven) of constructed, permanent off channel wetlands.
  - If successful breeding in at least two created wetlands is not demonstrated during the two year 'frog migration' period (i.e. during annual Growling Grass Frog monitoring), at least an additional year of 'adaptive management' will be initiated (see Section 7.4.9).

#### Potential corrective action

- Additional signage along fence line to prevent construction workers entering the habitat corridor.
- Improve site inductions
- Implement adaptive management (section 7.4.9)

### 7.4.9 Adaptive management phase

The adaptive management phase aims to ensure that constructed wetlands meet the habitat requirements of Growling Grass Frog and breeding populations of Growling Grass Frog have successfully established in the wetlands. Adaptive management refers to three suites of activities:

- corrective habitat management
- novel techniques, and
- pre-construction salvage and relocation.

#### Corrective habitat management

If colonisation of established wetlands by Growling Grass Frog is limited following the first breeding season, corrective habitat management will be undertaken. The corrective actions will depend on an ecological assessment of the factors inhibiting colonisation of the created wetlands (e.g. poor water quality, poor establishment of vegetation, inappropriate hydroperiod, high predation, low connectivity).

*Management actions*

While specific management actions are unknown they are likely to include some of the following actions:

- Improve water delivery to constructed wetlands to increase water levels in wetlands
- Measures to improve water quality at constructed wetlands, including:
  - Installing traps to collect sediment, pollution and rubbish.
  - Modifying water sources (e.g. ratio of slightly saline groundwater to freshwater).
  - Drain and refill wetlands with poor quality water.
- Improving revegetation and management of wetlands or terrestrial habitat, including:
  - More revegetation to improve terrestrial and aquatic plant cover and replace lost plants.
  - Change revegetation species suite.
  - Increase mowing to improve open areas for movement, foraging and basking.
  - Controlling weeds
- Improve other aspects of habitat such as:
  - The provision of more rocky areas on the shoreline and in shallow areas for basking.
  - Provide more logs and rocks in the vicinity of wetlands for perching and overwintering.
- If wetlands become clogged with emergent vegetation, remove emergent vegetation and plant submergent vegetation.
- Remove any barriers to migration, such as thick vegetation and large open areas, between existing and constructed wetlands.
- Draining constructed wetlands to remove exotic fish.
- Conduct salvage and relocation of Growling Grass Frog in existing habitat. See section 7.4.16 for further information.

*Performance criteria*

- Prior to construction commencing in existing Growling Grass Frog habitat, the following criteria will be met:
  - Successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season.
  - Growling Grass Frogs recorded in 50% of permanent off channel wetlands.

*Potential corrective action*

- Environmental consultants review this management plan, particularly habitat corridor design and management to identify any previously unrecognised issues, and determine new management actions to improve Growling Grass Frog habitat in the habitat corridor.

### Novel management techniques

If at the end of the second breeding season, the successful frog migration criteria are not met, novel management techniques should be implemented. These techniques may encourage Growling Grass Frog to migrate to the constructed wetlands.

*Management actions*

While specific management actions are unknown they are likely to include some of the following actions:

- Encourage frog movement by reducing water levels in existing quarry wetlands (i.e. wetlands 2, 3 and 4; Figure 2);
- Net wetlands to reduce predation, especially from birds; and/or
- Other novel management options such as trialling call playback of Growling Grass Frog calls at constructed wetlands to attract Growling Grass Frogs. Call-playback has been shown to attract some species of frog, but not others (Buxton *et al.* 2015)

*Performance criteria*

- Prior to construction commencing in existing Growling Grass Frog habitat, the following criteria will be met:
  - Successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season.
  - Growling Grass Frogs recorded in 50% of permanent off channel wetlands.

*Potential corrective action*

- Explore additional novel management actions to encourage Growling Grass Frog to migrate to constructed wetlands.

### Pre-construction salvage and relocation

If, after two full breeding seasons, the criteria for a successful migration phase (i.e. Growling Grass Frogs recorded in 50% of created wetlands, successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season) have not been met, Growling Grass Frogs will be caught in existing wetlands and relocated to constructed wetlands. Salvage and relocation will follow the procedures outlined in section 7.4.16. Frogs would be salvaged during nocturnal surveys.

If salvage and relocation is required as part of the adaptive management phase, removal of existing Growling Grass Frog habitat will be delayed by a year to ensure that Growling Grass Frog survive and persist in the constructed wetlands and the successful migration phase criteria are met.

*Management actions*

- If criteria for a successful migration phase have not been met at the end of the second breeding season, salvage and relocation of Growling Grass Frogs will be initiated (see section 7.4.16)
- If salvage and relocation is required during the adaptive management phase, the removal of existing Growling Grass Frog habitat will be delayed by a year to ensure that Growling Grass Frog survive and persist in the constructed wetlands and the successful migration phase criteria are met.

*Performance criteria*

- Prior to construction commencing in existing Growling Grass Frog habitat, the following criteria will be met:

- Successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season.
- Growling Grass Frogs recorded in 50% of permanent off channel wetlands.

*Potential corrective action*

- Consider additional actions, such as draining existing habitats or improving habitat quality in constructed wetlands.

### 7.4.10 Construction phase – east of habitat corridor

Construction may commence on the eastern side of the habitat corridor (i.e. the Urban and Health Quarters, Figure 5) during the construction of the habitat corridor and/or the frog migration phase. Temporary frog fencing will need to be constructed to prevent frogs entering construction zones. Controls will be put in place to stop sediments and pollutants from entering the habitat corridor. There will also be no works or lighting at night during construction of the precincts.

#### Management actions

- Install temporary frog and exclusion fencing along edge of habitat corridor to prevent frogs entering the construction zone and construction workers entering the habitat corridor. This temporary fencing can be removed once construction in the precincts has finished.
- No go area signage will be erected along the fence line.
- Sediment control devices will be installed to prevent sediment from flowing into the habitat corridor.
- In areas where chemicals, fuels and oils are being stored, adequate bunding will be constructed to prevent any spills from spreading and entering the habitat corridor. These storage areas will be located as far as practicable from the habitat corridor and watercourses.
- No lighting or construction works will be permitted at night during the construction of the precinct.
- Site inductions for all construction workers will discuss Growling Grass Frogs, the habitat corridor and no go zones.
- Regular inspections of fence lines to make sure they are intact, and no works or dumping is occurring in the habitat corridor

#### Performance criteria

- All above management actions are implemented.

#### Potential corrective actions

- Improve site inductions to better cover environmental issues on site.
- Increase inspections along the fence line.
- Move chemical storage areas.
- Improve sediment control measures in the construction areas.

### 7.4.11 Construction phase – west of habitat corridor

Construction in areas west of the habitat corridor (i.e. the Green Quarter) can only commence once the performance criteria for the migration phase have been met. Prior to the commencement of construction in this area, Growling Grass Frog will likely be spread across the constructed wetlands and the existing habitats. As a result pre-construction salvage and relocation immediately prior to works in existing Growling Grass Frog habitat will be required to remove any Growling Grass Frogs still present. Prior to salvage, most water could be pumped out of existing wetlands to encourage Growling Grass Frogs to move to constructed wetlands, and to increase the success of salvage and relocation.

Following salvage and relocation, Growling Grass Frog habitat can be cleared. Once existing habitat is removed, frog fencing will be installed to prevent Growling Grass Frogs from entering the construction zone.

#### Management actions

- Prior to salvage and relocation, water levels in existing wetlands could be drawndown to encourage Growling Grass Frogs to move to constructed wetlands and increase salvage efficacy. Note that this will only be effective during the active period (October to March).
- Conduct salvage and relocation of Growling Grass Frog in existing wetlands and within 20 m of existing wetlands immediately prior (i.e. within 2 days) to construction works in existing habitat. See section 7.4.16 for salvage and relocation methodology.
- Construct frog fencing along western boundary of habitat corridor following salvage and relocation operations.
- Remaining management actions follow those outlined in Section 7.4.10.

#### Performance criteria

- Salvage and relocation conducted at existing wetlands immediately prior to construction.
- No recorded Growling Grass Frog mortality during construction.
- Frog fencing constructed following operations.

#### Potential corrective actions

- Conduct further salvage and relocation of Growling Grass Frogs if additional frogs found following initial salvage operations.

### 7.4.12 Pest animal control

Introduced predators such as Eastern Gambusia and Red Foxes pose a threat to Growling Grass Frog within the Precinct.

#### Eastern Gambusia (*Gambusia holbrooki*) and other predatory fish

Eastern Gambusia is a potential predator of Growling Grass Frog eggs and tadpoles (Anstis 2002) and has been implicated in the decline of this species (Robertson *et al.* 2002). Eastern Gambusia and other predatory fish may become an issue in the created wetlands if not properly managed.

*Management Actions*

- All stocking of exotic fish or non-indigenous fish within the wetland reserves is prohibited.
  - Signage stating that the release of fish into the wetlands is prohibited will be installed on site.
- Conduct regular surveys of the wetlands to ensure no exotic fish have entered the system (e.g. twice yearly, including prior to the breeding season).
- If exotic or non-indigenous fish are detected, a control plan will be required and implemented by a fish specialist. Although, a number of control techniques exist (e.g. chemical control, mechanical control and habitat manipulation), draining via pumping is generally considered the best option to control fish as it assures eradication of all fish. If exotic fish are found to be present, the wetland will be drained.
- However, if exotic fish are found over the breeding season, the wetland will only be drained at the end of the breeding season (i.e. March) so there is no impacts to Growling Grass Frog eggs or mortality of tadpoles. Consultation will be required with fish experts, Melbourne Water, DELWP, City of Whittlesea and/or a zoologist to ensure the draining will not have an impact on the Growling Grass Frog (e.g. larval development).
  - Wetlands will only be drained outside the breeding season (i.e. drain wetlands between March and September).

### Performance criteria

- Inspect wetlands for exotic fish twice per year, with one inspection early enough before the breeding season (e.g. August) so wetlands can be drained and refilled prior to the breeding season.
- If wetlands are found to contain exotic fish, drain wetlands outside the breeding season.
- Install signage stating that release of fish into wetlands is prohibited.

### Potential corrective action

- If exotic fish are regularly found in the wetlands, consider further works to reduce potential access points, such as:
  - Installing fish exclusion devices inlet/ outlet pipes to prevent fish swimming through pipes.
  - Increasing the height of the bank between Edgars Creek and the wetlands if it is being overtopped regularly.
- Install additional signage regarding the release of fish.

### Red Foxes *(Vulpes vulpes)*

Fox predation is outlined as a Threatening Process in the Action Statement produced under the FFG Act (Mansergh and Marks 1993), and is also a threatening process under the EPBC Act. As foxes are highly mobile and would occur in surrounding areas, any control action on foxes would be potentially futile unless surrounding land managers and owners also took similar action in a co-coordinated community-based scheme over a large area (Saunders *et al.* 1995). However, any den sites located within the study area will be destroyed when found.

*Management Actions*

- Destroy dens found on-site.
- If possible, coordinate a community wide effort to control foxes with DELWP, City of Whittlesea, Parks Victoria, Melbourne Water and local residents.
- Remove all food waste and utilise interpretive signage to notify visitors that leaving food waste and rubbish in open space areas may encourage foxes and other pest animals, such as rodents.

*Performance criteria*

- Destroy fox dens found on site
- Empty public rubbish bins regularly, especially at picnic or barbeque area.

*Potential corrective action*

If foxes become a major issue on site, the following corrective actions could be implemented.

- Perform regular inspections of the habitat corridor.
- Empty rubbish bins more regularly and/or provide larger and/or more secure rubbish bins.

### 7.4.13 Chytrid control

While chytrid fungus is already widespread in the surrounding catchments and most likely the project area, the further spread of chytrid as a result of the New Epping development will be minimised through adherence to best-practice hygiene protocols (e.g. Murray *et al.* 2010).

#### Management actions

- Discuss chytrid and its management during environmental inductions.
- ~~When constructing and working in the habitat corridor:~~
  - ~~Clean vehicles coming on site at a designated wash down area and/or ensure vehicles have been washed down immediately prior to coming on site.~~
  - ~~Clean and disinfect equipment to minimise the risk of introducing or spreading chytrid fungus.~~
  - ~~Clean and disinfect footwear when working around Growling Grass Frog habitats, including during salvage and relocation.~~

Refer to update #49

- Appropriate handling of Growling Grass Frog during salvage and relocation (see section 7.4.16)
- Wetlands maintained at varying salinities to suppress chytrid infection (Stockwell *et al.* 2015)
- 20-40% of the perimeter of constructed wetlands consist of warm, shallow rocky areas which supress chytrid infection.
- Remove any shrubs or trees > 2m tall within 10 m of wetlands, to ensure that wetlands are not shaded.

#### Performance criteria

- Disinfection facilities available for use and their usage to wash down vehicles and equipment documented.
- No major Growling Grass Frog population declines outside of expectations based on annual conditions.

#### Potential corrective action

- Cover chytrid management in more detail during inductions.
- If chytrid is suspected to be causing major population declines in specific wetlands, test the chytrid loads on resident Growling Grass Frogs. If mean zoospore loads are above >10,000 per swab a level thought to be lethal in a variety of amphibians (Kinney *et al.* 2011; Heard, Scroggie, and Clemann 2012), drain the wetlands and allow the wetland to dry out.
- If chytrid infection is widespread, consider increasing the salinity of the wetlands or the areas of shallow rock around the wetland.

### 7.4.14 Infrastructure

#### Fencing

Fencing will be constructed to prevent Growling Grass Frog from entering construction zones and urban areas, and to prevent people, machinery and pets form entering Growling Grass Frog habitat.

*Management actions*

- Temporary exclusion fencing around existing Growling Grass Frog habitat during construction of the habitat corridor (Figure 12).
- The following temporary frog and exclusion fencing around the habitat corridor will be staged over the development of the site (Figure 12) :
  - Along eastern side of Edgars Creek during construction of precincts on the eastern side of Edgar's Creek.
  - Around existing habitat and the habitat corridor during the migration phase.
  - Along the western edge of the habitat corridor during the construction of precincts on the western side of the habitat corridor.
- Following construction, permanent fencing will be located as follows (Figure 13):
  - Safety/exclusion fencing around the northern wetland cluster (the existing quarry pit, ponds 6 and 7 and ephemeral ponds 2 and 3) and neighbouring sections of Edgars Creek to prevent people entering core Growling Grass Frog habitat and falling into the quarry pit
  - Vehicle exclusion fencing around the entire habitat corridor to prevent vehicle access.
  - Frog fencing along the entire western boundary of the habitat corridor to prevent Growling Grass Frog entering residential areas. This fencing can have regular breaks to allow pedestrian access to the habitat corridor.

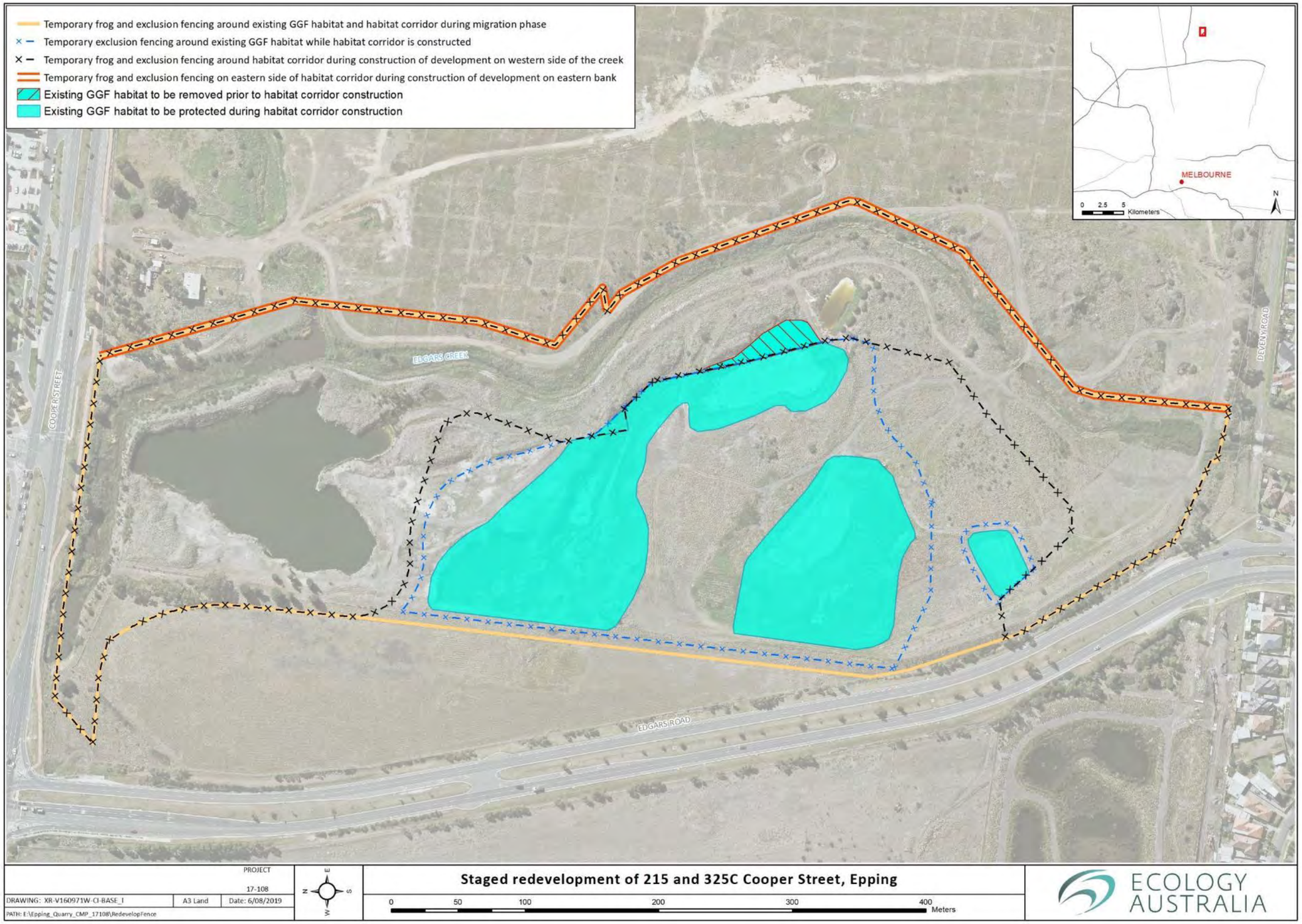
- Frog fences must meet the following design criteria
  - The material used should be a relatively solid, low-maintenance material with small openings for light and air movement and to reduce visual impact, and should be durable under exposed, outdoor conditions. We recommend material such as perforated metal sheet or strong mesh, with openings of roughly 1 cm or smaller.
  - The fence will be a minimum height of 800 mm above ground level.
  - Buried at least 100 mm into the ground at the base.
  - An overhang at the top of the fence, on the inside, of at least 20 cm wide - i.e. side profile: '⅂'.
  - Understorey vegetation will not be planted within 1 m of the inside of the fence.
- Exclusion/safety fences will be a mesh fence at least 1.2 m high.
- Vehicle exclusion fences will be a solid fence 1.2 m high with regular gaps to allow for pedestrian movement.
- Specific design of fences is flexible as long as criteria are met. For example a ha-ha wall could be constructed to meet frog fencing design criteria.
- Where fence types are parallel to each other, they can be combined into a single fence to meet design criteria.
- Fences must be adequately maintained to meet the design criteria (e.g. fix breakages, vegetation routinely cleared).
- No go areas and exclusion fencing covered in on site inductions.

### Performance criteria

- Temporary fencing and permanent fencing constructed as outlined above.

### Potential corrective action

- Cover no-go areas and fencing in more detail in site inductions.
- Inspect fencing more regularly and repair any damage.




Refer to update #50

**Figure 12 Indicative locations and timing of frog and exclusion fences during construction of habitat corridor and development precincts.**


**Figure 13 Indicative locations of permanent frog, safety and exclusion fencing along the habitat corridor.**

### Artificial Light

While its specific impacts on Growling Grass Frog are unknown, artificial lighting can modify behaviour, reduce foraging and reproductive success and increase physiological stress and predation risk in frogs. As a result, lighting needs to be designed to minimise potential impacts on Growling Grass Frog.

*Management actions*

- Construction limited to daylight hours so no artificial light is used.
- No lighting is directed towards the creek or wetlands.
- Space lights as far apart as practical to minimise unnecessary lighting.
- Put shields on lights to prevent lateral light spill and to ensure light is restricted to areas needing illumination.
- Use embedded lights on walkways where possible.
- Use motion sensor-activated lights where possible.
- Keep lighting as far from creek as practical.
- Avoid high intensity lights in white or blue range (<50 nm wavelengths) as these have the greatest effect on physiology.

*Performance criteria*

- Construction during daylight hours only.
- Light spill kept to a minimum.

*Possible corrective action*

- Improve measures to reduce light spill (e.g. shield on lights).

### Noise

Noise principally affects frogs by reducing the likelihood of attracting mates, as they cannot hear their calls, however the full suite of impacts are likely similar to those outlined above under artificial lighting. Noise on site will likely be high during construction, but following construction, chronic loud noise will largely be restricted to existing roads.

*Management actions*

- Construction restricted to daylight hours to minimise impacts on Growling Grass Frog.
- Noise pollution from construction machinery will be reduced as far as possible with standard noise reduction equipment and comply with EPA guidelines and City of Whittlesea Planning permit requirements.

*Performance criteria*

- Noise kept below EPA guidelines and permit requirements.

*Possible corrective action*

- Repair/replace noisy construction machinery.

### Roads, paths and creek crossings

A 1.5 m to 2.5 m wide gravel path will run the length of the habitat corridor and cater to pedestrian and bicycle traffic and allow access for management vehicles. Two bridges will also be constructed over Edgars Creek, one for vehicle traffic and another for the shared path. Roads and footpaths will be constructed adjacent to the habitat corridor. To minimise the risks posed from this infrastructure, the following mitigation and management actions will be implemented.

*Management actions*

- Pathways will be located at least 15m to 30 m from water bodies and roads at least 20 m to 40 m from water bodies except at crossings and viewing areas.
- Abutments for bridges will be at least 5 m back from the top of the bank.
- Abutments and pier footings for road crossing to be constructed during pre-construction phase when habitat corridor is being established. This will minimise the impacts to the habitat corridor when the bridge is constructed.
  - During construction of the bridge, vegetation and ground disturbance will be kept to a minimum. The landform and vegetation will be reinstated as per landscaping plans following bridge construction.
- Footbridge to be constructed during the post-construction phase and designed to maximise movement of Growling Grass Frogs.
- Thirty percent of the road crossing on the western side of the bridge needs to be open for Growling Grass Frog passage.
- Road crossing will include culverts on the western side of Edgars Creek designed to allow for Growling Grass Frog passage. The design of culverts will follow those outlined in DELWP (2017c) and include:
  - A natural substrate.
  - Be as short as possible (i.e. start the culvert as close as possible to the road edge.
  - A horizontal opening of at least 10 m
  - Install microclimate vents to allow light and moisture to penetrate the culvert. These will:
    (i) Have footprint of at least 1 metre x 1 metre and preferably much larger.
    (ii) Be placed adjacent to the kerb and channel on either side of a two lane road.
    (iii) Have an additional vent in the central median for larger roads so that there is no more than 10 metres between vents
    (iv) Consist of a “grated lid” with a 500 mm concrete surround that falls towards the grate.
- The road bridge and culverts will include drift fencing to direct Growling Grass Frogs towards these safe crossings and away from crossing the road. The drift fencing will:
  - Be installed upstream and downstream of the bridge and culvert.

- Will be angled at 45 degrees from the creek to funnel toads towards to bridge and culvert openings.
- Follow the design and vegetation management outlined for frog fencing (see above)
- Provision of rocks and large woody debris to provide shelter for Growling Grass Frog, but more than 1 m from the fence so they don't inhibit movement.

*Performance criteria*

- Pathways will be located at least 10m from water bodies and roads at least 20m from water bodies except at crossings and viewing areas.
- Road bridge abutments constructed when habitat corridor constructed.
- Bridge and culvert design follows that outlined above.
- Drift fencing installed at entrance to culvert and bridge.

*Potential corrective action*

- Regularly inspect drift fencing for damage.
- If design of bridge does not match that outlined above, explore solutions improve the bridge design to enable Growling Grass Frog passage.
- Relocate paths further from wetlands if too close.

### Shade

Shading from vegetation and buildings can effect Growling Grass Frog populations. Shading reduces water temperatures, basking opportunities and insolation, which can then reduce Growling Grass Frog development and growth rates, reduce wetland productivity and increase incidence of chytrid.

*Management actions*

- No trees or shrubs will be planted within the habitat corridor that will directly shade created wetlands or the 10 m vegetation buffer around them; and
- The cover of trees and shrubs in terrestrial habitat (i.e. areas not within 10 m of wetlands) within the habitat corridor will not exceed 10% (DELWP 2017b).
- Buildings will be designed not to exceed the following levels of shading of the habitat corridor and associated wetlands on the proscribed dates.
    - *September (22nd):*
    - 0% shading of wetlands and 10 m wetland buffers from the building envelope between 8am and 5pm.
    - Approximately 10% or less shading of terrestrial habitat between 9am and 4pm (shading will be effectively absent during the middle of each day).
    - *December (22$^{nd}$):*
    - 0% shading of wetlands and 10 m wetland buffers between 8am and 5pm (and less than 5% of the wetlands and 10 m buffers are shaded at 7am and 6pm in December).
    - Approximately 5% or less shading of terrestrial habitat between 9am and 5pm.

- *March (22nd):*
  - 0% shading of wetlands and 10 m wetland buffers between 8am and 5pm.
  - Approximately 5% or less shading of terrestrial habitat between 10am and 4pm.

*Performance criteria*

- Shading levels outlined above not exceeded.

*Potential corrective actions*

- Modify building design if they create excessive shading of wetlands.

### Storm water infrastructure

Aside from one potential stormwater treatment wetland for the water distribution network, stormwater drainage (e.g. piping and outlets) will be constructed when the residential area is being built, after the habitat corridor is completed. As a result, the habitat corridor will be impacted. The construction footprint for stormwater infrastructure will be kept to a minimum and key Growling Grass Frog habitat (i.e. constructed wetlands plus the 10 m buffer) will be avoided entirely. Before any riparian habitat and terrestrial refuge habitat (i.e. tussock grasses, logs, rocks) habitat is cleared, pre clearance checks and salvage will be conducted to prevent the death of any Growling Grass Frogs. Outlets will be constructed so that erosion and loss of vegetation following rainfall is kept to a minimum. Any damage to the habitat corridor during construction will be appropriately rehabilitated.

Excluding the wetland to treat stormwater for providing water to Growling Grass Frog pond 6, constructing storm water treatment wetlands in the habitat corridor will be avoided to prevent the loss of terrestrial habitat.

Storm water quality for pond 6 is covered in section 7.4.5.

*Management actions*

- Minimise the construction footprint when constructing stormwater infrastructure in the habitat corridor.
- Storm water infrastructure and the construction footprint will avoid constructed wetlands by at least 10 m.
- Prior to construction, pre-clearance checks will be conducted to determine whether any Growling Grass Frogs are present, and if found they will be relocated to a nearby wetland that will not be impacted by construction.
- Rehabilitate areas affected by the construction of stormwater infrastructure.
- No storm water treatment wetlands will be constructed in the habitat corridor, except for one that may be required to provide water for wetland 6.

*Performance criteria*

- Stormwater drains not constructed within 10 m of constructed wetlands.
- Area impacted by the construction of storm water drains properly remediated and revegetated.
- Pre-clearance checks for Growling Grass Frog conducted where required prior to works.

*Potential corrective action*

- If revegetation is poor, improve the revegetation.
- Perform further pre-clearance checks if more frogs are uncovered.

### 7.4.15 User related issues

Pedestrians, cyclists and pets have the capacity to impact Growling Grass Frogs. The following management actions will be implemented to reduce the potential impacts people and pets on Growling Grass Frogs.

#### Management actions

- Where pathways cross or come close to the Growling Grass Frog wetlands and Edgars Creek, boardwalks will be constructed. This will minimise trampling and damage to vegetation, while still allowing the passage of frogs.
- Install signage stating that dogs must be on a leash within 50m of Growling Grass Frog wetlands.
- Prohibit the removal of fallen timber and other plant material.
- Prohibit the introduction of exotic fish into the creek or wetlands. This will be particularly important to maintain potential breeding habitat for Growling Grass Frog in the wetland reserves. Signage will be posted prohibiting the release of fish in wetlands.
- Enforce a strict 'no dumping policy' for rubbish or litter (e.g. signs with litter fine amounts). Signage at public facilities (e.g. BBQs and picnic areas) should discourage people from leaving food waste and rubbish as they may encourage pest animals such as foxes and rodents.
- Support community education programs (e.g. Melbourne Water's Waterwatch and Frog Census) and encouraging participation and support for local community groups (e.g. Friends of Edgars/Merri Creek groups).
- Create an exclusion zone around quarry water body and associated wetlands to protect the core Growling Grass Frog population. Appropriate permanent fencing will be installed to exclude public access and preserve Growling Grass Frog habitat (see section 7.4.14).
- Providing interpretive signage for Growling Grass Frog in areas of interest. Signage is important in order to educate the public on values that occur within the Precinct.

#### Performance criteria

- Pathways and fencing constructed to preserve Growling Grass Frog habitat as outlined above.
- Informative signage installed along pathways and at "nodes" outlining the ecology and conservation status of Growling Grass Frogs.
- Adequate signage installed indicating that the following is prohibited
  - Walking dogs off leash within 50 m of Growling Grass Frog wetlands.
  - Removing plant material and fallen timber
  - Releasing fish into wetlands.

- Dumping of rubbish or littering.

**Possible corrective action**

- More exclusion fencing installed.
- Increased community education.
- Increased signage along the habitat corridor.

### 7.4.16 Salvage and relocation protocols for Growling Grass Frog

Four types of salvage and relocation of Growling Grass Frog may be undertaken as part of the proposed New Epping Development:

- Immediately prior to the removal and piping of the drainage line that runs across the north-eastern portions of the property. This includes works associated with wetland 12 to construct the new drain outlet and improve hydrological performance. Salvage and relocation will occur within 10 m of the drainage line and wetland 12.
- Immediately prior to the removal of habitat in and adjacent to wetland 4 during construction of the habitat corridor, salvage and relocation will occur within 10 m of the wetland.
- Pre-construction salvage and relocation. As discussed in section 7.4.9, salvage and relocation of individual frogs from existing wetlands into created wetlands may be required during the adaptive management phase of the proposed action if frogs do not migrate on their own.
- Salvage and relocation will occur during the removal of wetlands and associated habitat during the construction period.

It is important to note that salvage and relocation of Growling Grass Frogs is an experimental approach that has not yet been demonstrated as a viable mitigation technique for this species (Heard *et al.* 2010). The salvage and relocation protocols outlined here are considered experimental until adequate data can be collected concerning their effectiveness.

**Management actions:**

- Salvage and relocation protocols must be implemented prior to and as close as possible (i.e. within 3 days) to any disturbance involving any earth works or vegetation removal commencing within the no-go area (Figure 9) or within 20 m of other wetlands.
  - A long period between the relocation of frogs and construction works may result in frogs recolonising the area.
- Through inductions, contractors must be aware of their requirements with regard to salvage and relocation.
- A permit to salvage and relocate animals will be required from DELWP under the Victorian *Wildlife Act 1975*. Only people listed on the Victorian *Wildlife Act 1975* Management Authorisation will be permitted to handle native fauna.
- A qualified Zoologist with the requisite experience and permits will be engaged to undertake salvage and relocation of Growling Grass Frogs.

- Salvage and relocation will follow best-practice hygiene protocols (Section 7.4.13, Murray *et al.* 2011), to reduce the risk of transmission of chytrid fungus into new areas or to individual frogs. Hygiene measures will include
  - Footwear and equipment will be washed in disinfectant at the commencement and end of surveys for each individual wetland.
  - Vinyl gloves will be used when handling frogs, and a new set of gloves will be used for each individual frog.
  - Captured frogs will be placed in individual plastic bags for transport.
- Searches to locate Growling Grass Frogs will be different depending on whether they are undertaken during the active and inactive season.
- Searches for the Growling Grass Frog during the active period (September to April) will adhere to the following protocols:
  - Searches will be undertaken within three days of the commencement of construction activities at a given wetland.
  - At least two night-time spotlighting surveys will be undertaken at each wetland and each survey will involve two people searching for at least one hour. Night-time surveys (where possible) will be undertaken on nights of optimal weather for detecting the species (i.e. little or no wind, temperatures greater than 15°C, and relatively high humidity).
  - Night time call recognition and call playback surveys will also be used to locate males. Growling Grass Frog calls will be played for roughly one minute and the survey personnel will listen for responses.
  - A standard diurnal search will be undertaken in the habitat where construction activities will be taking place. Daytime searches will include investigation of potential shelter and basking sites and searching within dense vegetation, at the base of grass tussocks, on reed beds, under rocks and other surface debris.
- Searches for the Growling Grass Frog during the inactive period (May to August) will adhere to the following protocols:
  - Searches will be undertaken within three days of the commencement of construction activities at a given wetland.
  - A diurnal search will be undertaken along areas to be disturbed within the no go area and within 20m of existing wetland habitats.
  - Searches will occur during daylight and will include investigation of potential shelter sites and searching within dense vegetation, at the base of grass tussocks, within reed beds, under rocks and other surface debris.
- Frogs will be captured by hand.
- Captured Growling Grass Frogs will be tagged either with a microchip (i.e. PIT tag) or a visible implant (e.g. coloured elastomer) so that the fate of relocated frogs can be documented and the success of the relocation program evaluated.

- Captured frogs will be released as soon as possible (<12 hours) at constructed wetlands in dense vegetation or under rocks or woody debris at the edge of the water body.
- Sick/injured/visibly distressed frogs will be taken to the Amphibian Research Centre at Werribee for assessment.

#### Performance criteria

- Salvage and relocation occurs within 3 days of works in existing wetlands following guidelines outlined above
- Growling Grass Frogs not recorded in existing wetlands immediately prior to removal of wetlands.
- Tagged, relocated frogs recorded in wetlands during subsequent surveys.

#### Potential corrective actions

- If Growling Grass Frog recorded in wetlands following salvage and relocation operations, conduct another round of salvage and relocation.
- Consider draining wetlands following salvage, so habitat is no longer present.
- Consider alternative management actions for salvaged and relocated frogs, such as netting constructed wetlands to prevent Growling Grass Frogs leaving and/or reducing predation

### 7.4.17 Monitoring

The Growling Grass Frog population at the New Epping site will be monitored for the 10 year management period. Monitoring will be used to determine the success of the relocation, the persistence of the local population, the level of on-site breeding and whether management practices are effective or need to change.

Growling Grass Frog populations can fluctuate dramatically from season to season based on prevailing conditions. For example at the Epping Quarry site 27 individuals were recorded 2014-15 when conditions were poor (i.e. dry) compared to 84 individuals in 2016-17 when conditions were good. As a result, assessing the performance of constructed wetlands is complex.

Monitoring will adhere to the following protocols:

- Two nocturnal surveys of each water body (including in stream wetlands) during the main activity period (October-March). Where possible, the first survey will be conducted during early breeding season (October to December), and the second later in the season to determine if recruitment has occurred (i.e. the presence of metamorphs and juveniles).
- Each water body will be surveyed by two suitably qualified personnel for a period of at least 30 minutes, with total survey time determined by the size of the water body and habitat complexity.
- Three 50 m transects will be surveyed along the creek line.
- Surveys will proceed in the following order:

  - Call recognition to see if any male frogs are calling. This will include call playback, where Growling Grass Frog calls will be played for at least 1 minute and any responses listened for.
  - Undertake a visual inspection of the waterbody and vegetation with a spotlight and with the aid of binoculars.
  - Search the perimeter of the waterbody or edge of the creek for frogs, scanning vegetation on the banks and within the water body.
- Records will include:
  - The location (with a GPS), time and activity of each frog encountered/heard.
  - The microhabitat (e.g. sitting on floating pond weed in middle of wetland).
  - Where possible, identify the age class of individuals (e.g. snout to groin length = < 30 mm – metamorph; 30-50 mm sub-adult; and >50 mm adult).
- Footwear and equipment will be washed with disinfectant between water bodies to prevent the spread of chytrid.
- A report, including survey methods, results and discussion, as well as recommendations for changes in management regimes if required, will be written annually. It will include long term data sets so population size can be tracked through time.
- Surveys will continue for at least the 10 year management period, and removal of existing Growling Grass Frog habitat, and will only cease following discussions with DELWP and management of the wetlands is handed over to Melbourne Water.

### Management actions

- Growling Grass Frog surveys as outlined above conducted twice per active season for the ten year management period.

### Performance criteria

- Growling Grass Frogs surveyed annually.
- Populations not declining beyond what is expected based on conditions.
- Specific triggers for further management actions are as follows:
  - A decline of ≥10% in the number of individuals recorded during summer surveys over three successive years (during the 10 year management period).
  - An overall decline of >25% in annual average number of individuals recorded during summer surveys over a three-year period.
  - A decline of >50% in a single year.

### Potential corrective action

- Investigate potential causes of decline (e.g. low rainfall, predation, reduced habitat quality etc.)
- Increased habitat quality, including improving the following:

  - Water delivery.
  - Water quality.
  - Revegetation, particularly submergent and floating vegetation.
  - Weed management.
  - Shelter and basking sites (e.g. rocks and logs)
  - Terrestrial habitat (i.e. maintaining open spaces for foraging and movement)
  - Areas of submergent and floating vegetation, including removing some emergent vegetation if wetlands become overgrown.
- Increase monitoring of predatory fish, and if found, drain wetland(s)
- Improve waste management so predators such as foxes are not attracted to the area.
- Improve community engagement education to encourage people not to enter wetlands, keep dogs on leads in the habitat corridor and keep cats indoors.
- See corrective habitat management in section 7.4.9 for specific management details.

### 7.4.18 Golden Sun Moth offset

Impacts to the Golden Sun Moth at the site as a result of the project are considered to be unavoidable. Impacts to the Golden Sun Moth as a result of development proposal are proposed to be offset under the EPBC Act 1999 policy statement for the Melbourne urban development proposal, needing consideration under Parts 7, 8 and 9 of the EPBC Act – referred to as the Melbourne Urban Development Policy. This policy allows for eligible projects to be offset in-line with the Melbourne Strategic Assessment (MSA) framework. Specifically, the policy allows for up to 10 ha of Golden Sun Moth habitat or 10 ha of Natural Temperate Grassland of the Victorian Volcanic Plain to be offset within the Western Grassland Reserve.

Consistent with the MSA, Habitat Compensation fees would apply on a per-hectare basis for Golden Sun Moth habitat. The total area of the proposed Golden Sun Moth habitat removed as part of the development is 5.5318 ha, with the vast majority – 5.508 ha – occurring within Stage 2 of the development at 325C Cooper Street.

Management actions for the Golden Sun Moth are as follows:

- Offset 5.5318 ha of Golden Sun Moth in the Western Grassland Reserve.

## 7.5 Ongoing management after the 10 year management period

It is expected that at the end of the 10 year management period, the habitat corridor will be handed over to an appropriate government land manager being Melbourne Water and/or the City of Whittlesea to manage in perpetuity. After this 10 year management period, the management plan may be updated with the knowledge gained over the 10 year management period by Melbourne Water and/or the City of Whittlesea, so the Growling Grass Frog population and habitat can be best preserved.

Ongoing management actions after the 10 year management period are likely to be limited to:

- Standard ongoing vegetation management practices, including
  - Regular mowing of grassy areas (Section 7.4.6).

  - Controlling significant weeds (Section 7.4.7).
  - Replacing inappropriate plants, and dead or dying plants (Section 7.4.6).
- Infrequent management only of wetlands where required, such as:
  - Water level management in the constructed wetlands (Section 7.4.5).
  - Water quality monitoring and management (Section 7.4.5).
  - Controlling invasive fish in constructed wetlands, most likely after major flood events (i.e. 1 in 10 year floods when banks are overtopped). (Section7.4.12)

However, additional management activities may be required.

**Table 9 Schedule of management actions**

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| 1 and ongoing | **Staged development**<br>Development of New Epping will be staged to protect existing habitat until the habitat corridor has been constructed, it has been colonised by Growling Grass Frogs and there is evidence of breeding. Staged development underpins the whole EMP. | Throughout construction | Development of New Epping will be staged as follows:<br>1. Establish signed and fenced no-go areas around existing frog habitat prior to any works.<br>2. Construct and revegetate habitat corridor.<br>3. A two breeding season long frog migration phase<br>4. An adaptive management phase (if required)<br>5. Construction begins in existing Growling Grass Frog habitat. This phase includes salvage and relocation of Growling Grass Frogs.<br>6. Post construction phase following the removal of existing Growling Grass Frog habitat outside the habitat corridor. This will be outlined in a separate Offset Management Plan.<br>Further details of each stage are outlined below. | 7.4.1 |
| 1 and ongoing | **Establish no-go zones and temporary exclusion fencing**<br>Preserve existing habitat and subsequently the habitat corridor with no go areas during construction of the habitat corridor. | Prior to construction of habitat corridor | "No go" zone fencing and signage established around existing Growling Grass Frog habitat prior to any construction commencing. | 7.4.2 |
| | | Prior to construction east of habitat corridor | "No go" zone fencing and signage established along eastern edge of habitat corridor prior to any construction commencing east of the habitat corridor. | |
| | | Prior to removal of existing habitat | "No go" zone fencing and signage established around the habitat corridor prior to any construction commencing in existing habitat. | |
| | | Monthly | Fencing and "no go" zones inspected monthly for damage or evidence of dumping/activity. | |
| | | As required | "No go" zones discussed during on site inductions | |
| 1 and | **Pollution and sediment** | Prior to construction of | Protect existing habitat with pollution and sediment control devices in areas where | 7.4.2, 7.4.4 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| ongoing | **controls**<br>Protect exiting and constructed Growling Grass Frog habitat from pollutants and sedimentation. | habitat corridor | surface flows are directed towards existing Growling Grass Frog habitat. | |
| | | Prior to works commencing adjacent to habitat corridor. | Protect the habitat corridor with pollution and sediment control devices in areas where surface flows are directed towards Growling Grass Frog habitat. | |
| | | During construction | Install sediment traps at stormwater drain outlets.<br>Gross pollution traps installed on stormwater infrastructure.<br>If sedimentation and pollution are an issue, remove point sources and improve controls. | |
| 1 and ongoing | **Chemical and petroleum management**<br>Prevent chemical/hydrocarbon spills, and contain spills if they occur. | Prior to construction commencing. | Establish chemical and fuel storage area as far from Growling Grass Frog habitat as practical.<br>Chemicals and hydrocarbons to be stored in lined, bunded areas, with the bund able to contain 120% of the volume of the largest chemical container.<br>Spill kits provided on site in areas where chemicals are stored and in areas where construction is occurring. | 8 |
| | | Daily | Equipment inspected daily and undergo regular service.<br>Personnel adequately trained in equipment usage. | |
| 1 | **Remediate Edgars Creek and surrounding terrestrial habitat.**<br>Edgars Creek will be remediated to improve ecological function (including habitat for Growling Grass Frog) and hydrology. | Following establishment of no go zone. | Conduct pre clearance searches, salvage and relocation of Growling Grass Frogs in habitat to be cleared within 10 m of wetland 12.<br>Remediate creek as designed. Designed creek alignment has undergone hydrological assessment and has been approved by Melbourne Water.<br>Stockpile rocks and logs removed during remediation works for use in habitat corridor.<br>Install erosion control devices and use best practice techniques to reduce erosion prior to the establishment of vegetation.<br>Four in stream pools will be designed, managed and revegetated in line with Growling Grass Frog habitat design standards (DELWP 2017b) and section 7.4.4 | 7.4.3, 7.4.4 |
| 1 | **Create constructed wetlands.** | Following | Create off channel wetlands that meet the design criteria (e.g. layout, size, depth) | 7.4.4, 7.4.5 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | Ten new off channel wetlands specifically designed for growling grass frogs will be constructed. | establishment of no go zone. | outlined in this document (Section 7.4.4).<br>Wetlands constructed above 1 in 10 ARI to reduce the likelihood of colonisation by predatory fish.<br>Line wetlands with clay, covered with 30 cm of topsoil to reduce seepage.<br>Rock beaching to make up approximately 30-40% of the wetland margins.<br>Install water delivery system to maintain water levels in permanent Growling Grass Frog wetlands and fill ephemeral wetlands over the breeding season (see below). | |
| 1 and ongoing | **Revegetate the habitat corridor.**<br>Once earthworks and landscaping are complete, the habitat corridor will be revegetated. | Following earthworks and landscaping in habitat corridor | Revegetate habitat corridor using species indigenous to the area outlined in Table 6.<br>Revegetate with tube stock.<br>Four zones of vegetation will be established – terrestrial habitat, fringing vegetation zone, shallow emergent vegetation and permanent deep water with submergent and floating vegetation. Cover of submergent and floating vegetation will be 30-50%.<br>Terrestrial habitat will be managed in two zones.<br>• Within 10 m of wetlands, habitat will be more complex, and include ~45% cover of high complexity habitat such as tussock grasses, sedges and rushes, ~45% cover of low complexity habitat including mown grass and bare ground and 10% cover of rocks and logs. No trees or shrubs >2 m tall will be planted in this zone.<br>• More than 10 m from wetlands, mown grass will make up the majority (50% - 80%) of habitat with the remainder comprising tussock grasses and sedges.<br>No trees or shrubs > 2m to be planted within 10 m of wetlands, and cover of trees and shrubs will be <10% elsewhere. | 7.4.5 |
| | | Ongoing. | Increase planting density if cover of vegetation is too low.<br>Replace inappropriate vegetation. | |
| 1 and ongoing | **Install temporary frog fencing.**<br>Temporary frog fencing to be constructed to prevent frogs entering construction zones. | Prior to construction commencing east of habitat corridor. | Frog fencing to be constructed along eastern side of habitat corridor prior to construction commencing east of the habitat corridor.<br>Frog fences must meet the following design criteria:<br>• The material used should be a relatively solid, low-maintenance material with small openings for light and air movement such as perforated metal sheet or | 7.4.9, 7.4.13 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | | | strong mesh, with openings of roughly 1 cm or smaller.<br>• The fence will be >800 mm above ground level.<br>• Buried at least 100 mm underground at the base.<br>• An overhang at the top of the fence, on the inside, of at least 20 cm wide - i.e. side profile: 'ℸ'.<br>• Understorey vegetation will not be planted within 1 m of the inside of the fence. | |
| | | Immediately following the removal of existing frog habitat | Frog fencing to be constructed along western side of habitat corridor following salvage and relocation and the removal of existing habitat, but prior to the construction commencing west of the habitat corridor.<br>Design meets criteria outlined above. | |
| | | Monthly | Frog fencing must be inspected every month during construction. | |
| 1 and ongoing | **Manage water levels and water quality in constructed wetlands**<br>Ensure that constructed wetlands are permanent and ephemeral wetlands are full over the breeding season. | During construction of habitat corridor | A water delivery system will be constructed to enable each wetland to be filled with slightly saline groundwater from the main quarry waterbody and freshwater from additional water source(s).<br>Wetlands designed so they can easily be drained (i.e. drain to a single deep point) if predatory fish are found in the waterbody or wetlands become too saline.<br>Depth gauges installed in all wetlands. | 7.4.4 |
| | | Monthly following completion of habitat corridor, to be reviewed after two years. | Wetland water levels inspected monthly initially, with rate of inspection to be reviewed after two years.<br>Water levels maintained to a minimum of 0.5 m, but are regularly refilled to 1.5 m deep.<br>Managed ephemeral wetlands filled over springs and summer, and drawn down over winter.<br>Salinity measured monthly for the first two years following construction of habitat corridor, with rate of measurement to be reviewed thereafter.<br>~~Low salinity wetlands (wetlands 1, 3, 5, and 6) to be maintained at <3,000 µs/cm) and high salinity wetlands (wetlands 2, 4 and 7) to be maintained at <7,000 µs/cm.~~ | |

Refer to update #51

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | | Bi-annually, in September and autumn. | In depth water quality will be monitored at the prior to the breeding season (September) and again in autumn.<br>Water quality parameters will be kept in line with those outlined in Table 5.<br>Use of herbicides and fertilisers to be avoided where possible in the riparian areas, with mechanical removal the preferred weed control option. When used, herbicides which are commonly applied around aquatic environments will be directly sponged or wicked onto weeds. | |
| 1 and ongoing | **Annual Monitoring of Growling Grass Frog population and habitat**<br>Conduct monitoring of Growling Grass Frog population and breeding success over the breeding season. | Twice per breeding season | Every wetland and three 50 m long transects will be monitored twice per breeding season to determine the local population size and determine if breeding was successful.<br>Surveys follow DoEE survey guidelines (DEWHA 2009b), and include<br>• Call recognition including call playback, to see if Growling Grass Frog are calling.<br>• Searching the waterbody and surrounding habitat for Growling Grass Frog.<br>• Recording the location and size class of each individual.<br>Habitat quality will also be assessed.<br>An annual Growling Grass Frog monitoring report will be written, and include any new management actions to be implemented.<br>Surveys to continue for the 10 year management period (i.e. 10 years after the completion of the habitat corridor). | |
| 1 and ongoing | **Salvage and relocation of Growling Grass Frog during habitat removal**<br>Whenever Growling Grass Frog habitat is to be removed, salvage and relocation must occur immediately prior to habitat removal. | Immediately prior to removal of any Growling Grass Frog habitat | Salvage and relocation will be required immediately prior to construction commencing in existing habitat, including wetland 12, along Edgar's Creek, wetland 4 and the drain, and if any works are required in the habitat corridor once it is established. In addition, it may be required during the adaptive management phase.<br>Salvage and relocation must occur within 3 days of construction<br>A permit will be required for salvage and relocation works. .<br>Salvage and relocation will follow best-practice hygiene protocols.<br>Salvage and relocation will follow protocols outlined in section 6.4.15.<br>Relocated frogs will be tagged. | 7.4.15 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | | | Captured frogs will be released as soon as possible at constructed wetlands in areas with suitable cover. | |
| 1 and ongoing | **Chytrid management.**<br>Chytrid fungus can cause mortality in amphibians. While likely widespread in the project area, efforts will be made to minimise transition. | Construction of habitat corridor | Wash and sterilise equipment and machinery before coming on site.<br>Discuss chytrid during on site inductions.<br>Maintain constructed wetlands so warm, shallow, rocky areas cover at least 30-40% of the perimeter.<br>Maintain half of the wetlands (ponds 2, 4 and 7) so they are of higher salinity.<br>Shading of wetlands minimised by not planting shrubs or trees >2m within 10 m of wetlands and buildings built to comply with shade management actions. | 7.4.4, 7.4.12 |
| | | During salvage and relocation. | Follow handling guidelines for salvage and relocation (see section 6.4.15) | |
| | | Ongoing | Sterilise footwear before entering habitat corridor | |
| 1 and ongoing | **Shading**<br>Shading of wetlands can increase incidence of Chytrid infection. | During revegetation | Trees and shrubs >2 m will not be planted within 10 m of wetlands.<br>Cover of trees and shrubs >2 m elsewhere will not exceed 10% | 7.4.5, 7.4.13 |
| | | Housing design and construction. | Buildings will be designed and constructed not to exceed the levels of shade outlined in section .4.13 | |
| 1 and ongoing | **Construction of infrastructure in habitat corridor to minimise impact**<br>Impacts from constructing infrastructure in the habitat corridor (such as bridge, paths and stormwater outlets) will be minimised as far as possible. | During habitat corridor construction | Construct road bridge abutments during habitat corridor construction.<br>Abutments for bridges will be set back at least 5 m from creekline.<br>Crossings follow Growling Grass Frog crossing design criteria (DELWP 2017 c) including installing a culvert on western side of road bridge. | 7.4.13 |
| | | During construction of development | Pathways to be constructed > 15 m from wetlands and roads > 20 m away, except at crossings.<br>Construct stormwater infrastructure in a sensitive way to minimise impact to habitat corridor (e.g. small footprint).<br>Pathways may be constructed during the construction of the habitat corridor, or when the adjacent development area is constructed.<br>When construction works are required in the habitat corridor once it is completed, | |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | | | the following mitigations must be implemented:<br>• Minimise the extent of the area to be impacted as far a possible<br>• Infrastructure to avoid constructed wetlands by at least 10 m.<br>• Conduct pre construction checks for Growling Grass Frog and relocate any individuals encountered.<br>• Appropriately rehabilitate impacted areas.<br>Except for storm water outlets and a potential stormwater treatment plant to provide water for constructed wetlands, no storm water infrastructure will be constructed in the habitat corridor. | |
| 1 and ongoing | **Manage artificial lighting and noise**<br>Artificial light and noise will be kept to a minimum to reduce impacts to Growling Grass Frogs. | During construction activities | No construction at night.<br>Machinery to have standard noise reduction equipment, and comply with relevant EPA guidelines and council requirements. | 7.4.13 |
| | | Lighting design and install | Minimise lighting and light spill as much as possible by:<br>• Spacing lights as far apart as possible<br>• Keep lights as far as possible from creek and wetlands.<br>• Put shields on lights to reduce lateral light spill<br>• Use embedded lights on walkways<br>• Use motion sensor activated lights<br>• Avoid high intensity lights in white or blue range (<50 nm wavelengths) | |
| 1 and ongoing | **Monitor and control invasive species (particularly fish) in habitat corridor**<br>Predatory invasive species will be controlled to reduce Growling Grass Frog mortality. | During habitat corridor construction | Wetlands constructed at 1 in 10 ARI to reduce likelihood of colonisation by predatory fish. | 7.4.11 |
| | | Monitor fish in autumn and September. | Monitor off channel wetlands for predatory fish twice annually – once in autumn and again in September.<br>If predatory fish are found in wetland(s), drain wetland(s) outside Growling Grass Frog breeding season. | |
| | | Opportunistic | Destroy fox dens found on site. | |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| 1 and ongoing | **Construction of New Epping Development – east the habitat corridor** | Following the establishment of no-go zone around habitat corridor. | Construction east of the habitat corridor can commence during the construction of the habitat corridor.<br>Temporary frog fencing must be constructed along eastern edge of habitat corridor prior to construction commencing. Fence line inspected monthly. See section 6.4.13 for frog fencing design<br>Sediment and pollution controls installed to prevent contaminants entering the habitat corridor.<br>Salvage and relocation of Growling Grass Frog will occur immediately prior to works along the existing open drain and wetland 12. See section 6.4.15 for more information.<br>Construction limited to daylight hours.<br>Site inductions cover Growling Grass Frogs, no-go zones and habitat corridor. | 7.4.9, 7.4.13, 7.4.15 |
| 1 | **Golden Sun Moth offset**<br>Impacts to Golden Sun Moths will be offset. | | 5.5318 ha of Golden Sun Moth habitat will be offset in the Western Grassland Reserve. | 7.4.17 |
| 2-3 | **Frog migration phase lasting two breeding seasons**<br>Following the construction of the habitat corridor, a two breeding season long frog migration phase will occur | Following construction of the habitat corridor | No construction activities will occur in the habitat corridor or west of Edgars Creek during the frog migration phase (and adaptive management phase if required)<br>The fenced and signed no go area will be extended to include the habitat corridor and existing frog habitat following the completion of the habitat corridor.<br>Remove any stockpiles, fences or large tracks that may be a barrier to migration between constructed and existing wetlands.<br>Keep access to existing habitat and the habitat corridor to a minimum (i.e. only for monitoring and maintenance).<br>Frog migration phase complete after two full breeding seasons if the following criteria are met<br>1. Growling Grass Frogs present in 4 of 7 permanent constructed wetlands, and<br>2. Growling Grass Frog breeding recorded in two permanent constructed wetlands.<br>These criteria are based on the results of the Growling Grass Frog population | 7.4.7 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | | | modelling completed for the project area. If these criteria are not met, an adaptive management phase will occur. | |
| 2 and ongoing | **Monitor and managed vegetation in habitat corridor.**<br>Once constructed, habitat in the habitat corridor will need to be maintained (ongoing revegetation, slashing grass) | Twice annually (autumn and spring) | Monitoring of vegetation to be conducted in autumn and spring.<br>Replace dead or dying plants.<br>Increase planting density as required.<br>Remove inappropriate vegetation (e.g. any shrubs or trees >2 m within 10 m of wetlands, dense emergent vegetation if it is choking wetlands). | 7.4.5 |
| | | As required, based on annual conditions. | Mowing grassy areas to maintain a mixture of dense, tussock grasses and areas of low, grassy vegetation and bare ground.<br>Within 10 m of created/retained wetlands (the '10 m buffer'), mowing will be limited in frequency to reduce the risk of mortality of Growling Grass Frogs. | |
| 2 and ongoing | **Weed monitoring and control.**<br>Weeds outlined in table 7, woody weeds and emerging weeds will be controlled. | Monitoring quarterly for two years, then biannually. | Monitoring of weeds to be conducted quarterly for the first two years following construction of the habitat corridor, and bi-annually thereafter (in autumn and spring) | 7.4.5, 7.4.6 |
| | | Ongoing weed controls as required | Use of herbicides to be avoided where possible, particularly in the riparian areas, with mechanical removal the preferred weed control option.<br>When used in riparian areas, herbicides which are commonly applied around aquatic environments (in accordance with the product label) will be directly sponged or wicked onto weeds to minimise off target damage.<br>Herbicides must not be used within 10 m of wetlands during the breeding season (October-March). | |
| 3-4 | **Adaptive management phase.**<br>If criteria for Growling Grass Frog colonisation and breeding are not met by the end of the migration phase, | Following the end of the first year of the frog migration phase | No construction activities will occur in the habitat corridor or west of Edgars Creek during the adaptive management phase.<br>Improve revegetation in constructed Growling Grass Frog wetlands<br>Increase water levels and improve water quality in constructed Growling Grass Frog wetlands<br>Inspect constructed wetlands for invasive fish and drain if required. | 7.4.7, 7.4.8 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | and additional year of adaptive management will be required. Adaptive management of habitat quality may begin at the end of the first Growling Grass Frog breeding season if colonisation of constructed wetlands is poor. | | Remove vegetation if wetlands have become choked with emergent vegetation to improve cover of submergent and floating vegetation.<br>Improve movement between existing and created wetlands by mowing dense stands of vegetation. | |
| | | Following unsuccessful migration phase. | Explore novel techniques such as call playback to attract Growling Grass Frogs to constructed wetlands, or reducing water levels in existing wetlands 2 and 3 (figure 2) so existing habitat quality is reduced. | |
| | | Following unsuccessful additional year of adaptive management | Conduct salvage and relocation of Growling Grass Frog as a last resort if Growling Grass Frog do not colonise constructed wetlands after two breeding seasons independently. If salvage and relocation is required, a further year of adaptive management will be implemented. | |
| 3 and ongoing | **Install permanent fencing**<br>Permanent frog, exclusion and vehicle fencing will be installed along the western boundary of the habitat corridor. | During or following construction of areas east of habitat corridor | Vehicle exclusion fencing constructed on eastern edge of habitat corridor during or following construction in this area. This fence will be 1.2 m high with regular gaps to allow pedestrian movement. | 7.4.13 |
| | | During or following construction of areas west of habitat corridor | Permanent frog fencing installed along western edge of the habitat corridor during or at the end of construction of the development west of the habitat corridor.<br>Exclusion fencing installed around main quarry water body, associated wetlands and the northern section of Edgars Creek for safety and to protect core Growling Grass Frog habitat. This fence will be at least 1.2 m high and designed to deter pedestrians.<br>Vehicle exclusion fencing installed around entire habitat corridor. This fence will be 1.2 m high with regular gaps to allow pedestrian movement.<br>Fence design can be flexible as long as design criteria are met, and fences can be combined where they overlap, as long as criteria are met.<br>The fences will be inspected annually to ensure that the fence is in good condition. | |
| 4 and ongoing | **Construction of New Epping Development – west of the** | Following successful migration and | Construction west of the habitat corridor can commence after two breeding seasons following the completion of the habitat corridor and once the criteria for successful | 7.4.10, 7.4.13, 7.4.15 |

| Year | Objective | Timing of activity | Standard to be achieved | Related section(s) |
|---|---|---|---|---|
| | **habitat corridor** | adaptive management phase | migration/adaptive management are met.<br>Sediment and pollution controls installed to prevent contaminants entering the habitat corridor.<br>Prior to salvage and relocation works, existing waterbodies could be drawn down to encourage frogs to migrate to created habitat.<br>Salvage and relocation of Growling Grass Frog will occur immediately prior to works in areas of existing habitat. See section 6.4.15 for more information.<br>Temporary frog fencing will be constructed along western edge of habitat corridor once existing habitat is removed. Fence line inspected monthly. See section 6.4.13 for frog fencing design<br>Construction limited to daylight hours.<br>Site inductions cover Growling Grass Frogs, no-go zones and habitat corridor. | |
| 5 and ongoing | **User related issues** | Once construction is complete | Install signage as follows:<br>• Dogs on leash within 50 m of wetlands<br>• Prohibiting the removal of fallen timber<br>• Prohibiting the release of exotic fish in to wetlands<br>• No dumping of rubbish.<br>• Interpretive signage regarding Growling Grass Frog in the habitat corridor<br>Support community engagement projects.<br>Exclusion zone established around core Growling Grass Frog habitat associated with the main quarry waterbody. | 7.4.15 |

# 8 Risk Assessment

The environmental risk assessment covers all aspects of the development of the New Epping site that relate to the Growling Grass Frog and Golden Sun Moth.

## 8.1 Risk assessment methodology

This section describes the environmental risk assessment for potential events that may impact the environment during operational activities. The purpose of this assessment is to identify hazards and develop risk-reducing measures to prevent and mitigate impacts from operational activities. An environmental hazard-type assessment was undertaken to identify, analyse and evaluate the environmental risks associated with operation and to recommend management actions to reduce the risk to as low as reasonably possible (ALARP).

Environmental risk assessment consists of four basic steps:

1. Hazard identification.
4. Hazard analysis.
5. Risk evaluation.
6. Risk management.

These steps are described briefly below.

### 8.1.1 Hazard identification

Hazard identification involves identifying the sources of risk i.e. those activities or incidents that could result in an environmental impact. Hazards are categorised into those arising from routine operations, and those arising from incidents.

### 8.1.2 Hazard Analysis

Hazard analysis determines the likelihood of an activity or event occurring, and the consequences of that activity or event on the environment. A risk ranking matrix (Table 10) was used to assess the consequence and likelihood of all identified events. The matrix is based on five classifications each of likelihood (Table 11) and consequence (Table 12).

### 8.1.3 Risk Evaluation

Risk evaluation prioritises the risks i.e. determining if the risk of an activity or incident is acceptably low, or if management actions are required to reduce the risk to as low as reasonably practicable (ALARP). The risk evaluation presented in Table 13 takes existing safeguards/management measures into consideration i.e. represents the residual risk with existing or planned safeguards in place.

### 8.1.4 Risk Management

Table 7 presents the detailed assessment of risks, impacts and their management for the proposed development at New Epping.

**Table 10 Risk matrix**

| Likelihood | Consequence | | | | |
|---|---|---|---|---|---|
| | Minor | Moderate | High | Major | Critical |
| Highly Likely | Medium | High | High | Severe | Severe |
| Likely | Low | Medium | High | High | Severe |
| Possible | Low | Medium | Medium | High | Severe |
| Unlikely | Low | Low | Medium | High | High |
| Rare | Low | Low | Low | Medium | High |

**Table 11 Likelihood definitions**

| Likelihood | | Definition (based on qualitative assessment) |
|---|---|---|
| Rare | 1 | May occur in exceptional circumstances |
| Unlikely | 2 | Could occur but considered unlikely or doubtful |
| Possible | 3 | Might occur during the life of the project |
| Likely | 4 | Will probably occur during the life of the project |
| Highly Likely | 5 | Is expected to occur in most circumstances |

**Table 12 Consequence definitions**

| Consequence | | Definition (based on qualitative assessment) |
|---|---|---|
| Minor | 1 | Minor incident of environmental damage that can be reversed |
| Moderate | 2 | Isolated but substantial instances of environmental damage that could be reversed with intensive efforts |
| High | 3 | Substantial instances of environmental damage that could be reversed with intensive efforts |
| Major | 4 | Major loss of environmental amenity and real danger of continuing |
| Critical | 5 | Severe widespread loss of environmental amenity and irrecoverable environmental damage |

**Table 13 Risk assessment for the New Epping development**

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Growling Grass Frog killed during construction of habitat corridor | • Loss of individual Growling Grass Frog(s) leading to the decline of the local population size. | • Construction vehicles and/or personnel accidentally kill Growling Grass Frog | 2 | 4 | M | • Establish fenced no-go zones around existing Growling Grass Frog habitat to exclude frogs form construction areas.<br>• Install "no-go area, do not enter" signs at regular intervals along the fence line<br>• Discuss no-go zones in site inductions. | L |
| • Failure to establish suitable habitat for Growling Grass Frog | • Local population of Growling Grass Frog declines or goes extinct | • Constructed habitat is inappropriate for Growling Grass Frog.<br>• Vegetation fails to establish. | 4 | 3 | H | • Where possible design follows established best-practice design criteria for Growling Grass Frog wetlands, which includes:<br>– Gently sloping shallow areas with emergent vegetation and rocky patches (30-40% of wetland area) and deeper areas (>1.5 m, >35% of wetland area).<br>– A dense cover of submergent and emergent vegetation.<br>– Shallow rocky areas covering at least 20% of the margin wetlands that promote warm water and provide areas for basking.<br>• Where design standards are not met additional measures will be implemented to offset this. For example as wetland size criteria not met, a water distribution system will be constructed to maintain water levels in wetlands and ensure permanence.<br>• Revegetate the habitat corridor using appropriate local plant species.<br>• Install rocks and logs in the terrestrial portion of the habitat to provide shelter, particularly for overwintering.<br>• Manage terrestrial vegetation so there is a combination of dense tussocks grass and more open mown areas to enable foraging and movement between wetlands.<br>• No tall, shade forming vegetation within 10 m of the wetlands, and cover of tall, shade forming vegetation does not exceed 10% in any section of the habitat corridor.<br>• Ongoing management of vegetation, including replacing dead plants, removing weeds and slashing grassy areas.<br>• Adaptive management phase to address any initial construction issues, and may include further revegetation, further vegetation management and/or altering the bathymetry of constructed wetlands.<br>• Offset site secured to protect Growling Grass Frogs if they area lost on site. | M |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Growling Grass Frog fail to migrate to new habitat | • Local population of Growling Grass Frog declines or goes extinct | • Failure to establish correct Growling Grass Frog habitat in new wetlands<br>• Barriers prevent successful migration<br>• Relevant migratory cues not present | 3 | 2 | M | • Staged development gives Growling Grass Frogs two full active seasons (September 2020-April 2022) following the construction and revegetation of wetlands to migrate to new habitats.<br>• Minimise distance between existing and constructed wetlands.<br>• Manage terrestrial habitat between existing and constructed wetlands to encourage migration between wetlands by planting appropriate grasses and sedges and keeping the habitat open by slashing vegetation.<br>• Ensure that there are no barriers to migration (e.g. fences, wide tracks, large open unvegetated areas, stockpiles of soil and vegetation) between existing and constructed wetlands.<br>• Design meets established design criteria for constructed wetlands so they provide appropriate cues to attract Growling Grass Frog.<br>• If migration is slow, novel management actions, such as call playback of Growling Grass Frog calls at constructed wetlands, could be used to encourage migration of Growling Grass Frogs.<br>• Strict salvage and relocation protocols ensure that all Growling Grass Frog that fail to migrate are moved to constructed wetlands prior to the construction phase.<br>• High quality off-site offset site to be secured, which will act as “insurance” for the project. | L |
| • Layout of wetlands inappropriate | • Local population of Growling Grass Frog declines or goes extinct. | • Wetlands inappropriately spaced so there is no movement between constructed wetlands and populations are isolated. | 3 | 1 | L | • Wetland layout meets established design criteria for wetland spacing to ensure connectivity.<br>• Road and path creek crossings meet design criteria and the road includes an appropriately designed culvert on the western side of the creek.<br>• Modelling shows that local Growling Grass Frog population persistence is likely to be similar to existing layout under proposed design<br>• Terrestrial habitat between wetlands properly managed to maximise connectivity. | L |
| • Monitoring reveals population decline in post construction phase. | • Local population of Growling Grass Frog declines or goes extinct, which then impacts local metapopulation. | • Wetland habitat, design and/or layout inadequate. | 4 | 3 | H | • Growling Grass Frog population will be monitored two times per breeding season to assess the population and to detect declines as soon as possible.<br>• Monitoring and management of revegetation, weeds, invasive species, water levels and water quality will provide indication of environmental performance.<br>• In the event of population decline, adaptive management will be implemented with the help of qualified zoologists, DELWP and/or DoEE and will include, but will not be limited to:<br>– Modified revegetation.<br>– Increased vegetation management.<br>– Improving water quality.<br>– Controlling invasive species and weeds.<br>– Increase water temperature or salinity to reduce incidence of chytrid. | M |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Invasive species (e.g. Eastern Gambusia, foxes) establish in and around constructed wetlands. | • Invasive species consume Growling Grass Frog eggs, tadpoles and adults, leading to population decline | • Wetlands regularly connected to Edgars Creek.<br>• Habitat and resources (e.g. food scraps) provision promotes local fox population. | 2 | 4 | M | • The Growling Grass Frog wetlands established will be off channel and above the 1 in 10 years ARI to reduce the likelihood of Eastern Gambusia and other invasive aquatic species from establishing in the constructed wetlands.<br>• Install fish exclusion filters on water pumps, if water is pumped water from Edgars Creek into the constructed wetlands.<br>• Wetlands inspected for predatory fish twice annually, including in late August prior to the breeding season so corrective management actions can be implemented.<br>• Install signage saying the release of fish is prohibited.<br>• All wetlands designed so they can be drained and refilled in the event that invasive aquatic species become established (i.e. they drain to a central deep section)<br>– To eliminate the potential risks of draining wetlands on Growling Grass Frog eggs and tadpoles, wetlands will only be drained outside the breeding period (April-September).<br>• Three managed ephemeral wetlands will be established, and these will be allowed to dry out annually outside the Growling Grass Frog breeding season.<br>• As fox control requires a widespread effort to be successful, management controls on site will be restricted to:<br>– Destroying any dens discovered on site.<br>– Providing adequate rubbish bins along the pathway in the habitat corridor and at any picnic areas. These bins will be regularly emptied.<br>– Installing signage notifying visitors to remove rubbish to stop attracting pests.<br>• Dogs must be kept on their leads along the habitat corridor, and will be excluded from the retained quarry and associated wetlands. | L |
| • Weeds establish in habitat corridor | • Reduce Growling Grass Frog habitat quality. | • Inadequate hygiene control and weed management | 2 | 4 | M | • Vehicles, equipment and shoes washed down and inspected prior to accessing site to stop the spread of weeds.<br>• Exclusion zone established around the main quarry water body and associated wetlands will reduce the introduction of weeds.<br>• Quarterly inspection for high threat weeds in the habitat corridor during construction and the first two years post-construction of the habitat corridor. Bi annual weed inspections thereafter (i.e. in spring and autumn).<br>• High threat weeds will be removed using mechanical means where possible, however when not possible, herbicides which are legally certified to be used around aquatic environments will be used (e.g. Roundup Bi-active).<br>• During the breeding season (October to March) herbicides must not be sprayed within 10 m of a wetland, but herbicides may be directly applied to plants using a sponge or wick. | L |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Water quality is poor in wetlands. | • Poor quality water in constructed wetlands inhibits Growling Grass Frog population. | • Inadequate control of sediment and pollutants running into wetlands<br>• Wrong water source used to fill wetlands. | 2 | 3 | M | • During construction of New Epping, install sediment control fencing along habitat corridor and use best practice guidelines to reduce sediment runoff into existing habitats and the habitat corridor.<br>• During construction phase, ensure best practice to prevent fuel and other chemical spills on site.<br>• Filter any storm waters that are used to fill constructed wetlands.<br>• Minimise use of herbicides and fertilisers in the habitat corridor as much as possible.<br>• Manage wetlands so the salinities do not exceed values outlined in design criteria, as wetlands may become increasingly saline due to evaporation and concentration of salts. If salinity is a recurring issue, increase the amount of freshwater used to top up wetlands, and explore additional freshwater sources.<br>• Monitor salinity monthly for the first two years to ensure salinity in constructed wetlands do not exceed allowed levels. Review the rate of salinity monitoring<br>• Monitor water quality every spring and autumn following EPA guidelines for the first two years, and the timing of water quality monitoring reviewed after this period.<br>• If monitoring detects harmful levels of particular water quality attributes (e.g. metals, hydrocarbons), wetlands will be drained. If wetlands regularly exceed levels outlined in section 7.4.5 options for treating source water will be explored, and potential remedial action will be undertaken in consultation with EPA, DELWP and Council. | L |
| • Wetlands dry over summer | • Constructed wetlands dry out over summer before tadpoles have developed<br>• Reduction in Growling Grass Frog population | • Wetlands may be too small to be permanent naturally.<br>• Inadequate water distribution network. | 3 | 4 | H | • Water delivery system constructed to ensure that wetlands do not dry out. This water delivery system will use a variety of water sources including water from the main quarry pit, rooftop rainwater, treated rainwater. If necessary piped potable water or trucked water can also be used.<br>• Wetland water levels will be actively managed to ensure that they don't dry out.<br>• Constructed Growling Grass Frog wetlands will not be allowed to fall below 50 cm in depth.<br>• Trucked water can be pumped directly into wetlands as a last resort if water delivery system fails.<br>• Ponds clay lined to reduce leakage. | L |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Increase in incidence of chytrid fungus infection. | • Reduction of Growling Grass Frog population | • Chytrid introduced to constructed wetlands on vehicle, equipment and footwear.<br>• Wetlands improperly designed and increase likelihood of chyrtid.<br>• Low wetland salinity increases incidence of chytrid | 3 | 3 | M | • All machinery and equipment washed and disinfected prior to coming on site.<br>• Wetlands designed and managed to reduce incidence of chytrid infection by providing favourable water temperatures. Specifically:<br>– Preventing shading by not planting tall shrubs or constructing buildings adjacent to wetlands.<br>– Shallow, rocky areas will be provided in the constructed wetlands, covering 20-40% of the wetland perimeter<br>• Provide a range of salinities in the constructed wetlands to reduce chytrid infection and retaining the main quarry waterbody as a moderately saline refuge.<br>• Managed ephemeral wetlands will dry out every year outside of the Growling Grass Frog breeding season.<br>• If chytrid is thought to be is thought to be causing major population declines, test frogs for chytrid and if zoospore levels are >10,000 per swab, drain wetland and allow to dry out.<br>• Monitoring and salvage and relocation operations follow strict hygiene practices, specifically:<br>– Disinfect and clean footwear and equipment between sites.<br>– When handling Growling Grass Frog, use a new pair of vinyl gloves for each individual frog<br>– Transport Growling Grass Frogs in individual plastic bags. | L |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Frogs fail to successfully migrate to constructed wetlands. | • Growling Grass Frogs killed during construction, leading to reduction of local Growling Grass Frog population. | • Habitat at existing wetlands still suitable for Growling Grass Frogs<br>• Habitat at constructed wetlands not attracting Growling Grass Frogs. | 3 | 5 | H | • Strict performance criteria to determine the success of Growling Grass Frog migration phase. Specifically:<br>– Growling Grass Frogs recorded in >50% of constructed wetlands.<br>– Successful breeding of Growling Grass Frogs has been demonstrated in at least two of the constructed wetlands within the habitat corridor within a single breeding season<br>• If these criteria are not met, an adaptive management phase will be implemented.<br>• Adaptive management will be implemented as follows:<br>– Assessing the quality of Growling Grass Frog habitat in the habitat corridor, and improving habitat via revegetation, and weed, vegetation and water management.<br>– Salvage and relocation of all encountered Growling Grass Frogs at existing habitats prior to, during and following the drawing down of existing wetlands.<br>– Existing wetlands to be slowly dried out following initial salvage and relocation to encourage remaining frogs to migrate. Ongoing salvage and relocation to occur while wetlands are being drained.<br>• Monitoring and salvage and relocation operations follow strict hygiene practices, specifically:<br>– Disinfect and clean footwear and equipment between sites.<br>– When handling Growling Grass Frog, use a new pair of vinyl gloves for each individual frog<br>– Transport Growling Grass Frogs in individual plastic bags.<br>• During the active season (between September and April) Growling Grass Frog searches in areas where construction will take place will adhere to the following:<br>– At least two night time spotlight surveys at each wetlands, that last for at least one hour.<br>– Night time call recognition and call playback surveys will be used to locate males.<br>– A diurnal search for Growling Grass Frog, where potential shelter (under rocks and logs, at the base of grass tussocks and in reed beds) and basking sites will be investigated.<br>• Removal of existing frog habitat delayed for a further 12 months post relocation to determine if relocation is successful.<br>• During the inactive period (May to August), searches will be limited to the diurnal searches outlined above.<br>• Frogs captured by hand and released at constructed wetlands within 12 hours of capture.<br>• Site inductions will inform contractors of their obligations regarding Growling Grass Frog. | M |
| • Some frogs still remain in existing Growling Grass Frog habitat following the migration period. | • Growling Grass Frogs killed during construction, leading to reduction of local Growling Grass Frog population. | • Existing habitat suitable for Growling Grass Frogs<br>• Failure to establish suitable habitat in constructed wetlands<br>• Salvage and relocation fails to move all Growling Grass Frog to constructed wetlands | 2 | 5 | H | • At the end of the migration phase frogs will likely still occupy existing wetlands as the habitat present is suitable.<br>• Salvage and relocation performed within 3 days of starting construction in existing Growling Grass Frog habitat.<br>• Slowly drain existing wetlands following initial salvage and relocation to encourage remaining Growling Grass Frogs to leave.<br>• Salvage and relocation performed as outlined above.<br>• Site inductions will inform contractors of their obligations regarding Growling Grass Frog. | L |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Growling Grass Frog impacted by road and paths constructed in habitat corridor. | • Roads and paths impact Growling Grass Frog population indirectly through habitat degradation or loss or through direct mortality | • Improper planning means that road construction impacts Growling Grass Frog habitat corridor.<br>• Roads and paths not fenced.<br>• Roads and paths a barrier to Growling Grass Frog movement | 3 | 1 | L | • Layout will follow the design standards as far as possible.<br>• Paths and roads will be constructed as far as practicable from wetlands. Specifically, no paths constructed within 15 m of constructed wetlands, and no roads within 30 m of wetlands except at crossings.<br>• Construct abutments for road bridge while the habitat corridor is being constructed to minimise impacts to the habitat corridor following its construction.<br>• Culverts will be installed on the western side of the road bridge to improve connectivity between wetlands. The culvert will follow established design standards and include:<br>– A natural substrate.<br>– Be as short as possible.<br>– Install microclimate vents to allow light and moisture to penetrate the culvert.<br>• Culverts and bridges will include drift fencing at a 45° angle from the road to funnel frogs towards the culvert and bridge openings. Drift fencing will meet frog fencing design criteria.<br>• Frog fencing should be installed on the western side of the habitat corridor to prevent frogs dispersing on to roads and being run over. Frog fencing should meet the following criteria :<br>– Made from a solid, durable, low maintenance material with openings for air movement.<br>– It should be a minimum 800 mm high.<br>– Buried at least 100 mm below ground at the base<br>– Have a 20 cm overhang at the top of the fence, which overhangs into the habitat corridor.<br>– No understory vegetation within 1 m of the inside of the fence. | L |
| • Wetlands and habitat corridor degraded during construction of the residential and commercial areas. | • Direct mortality of Growling Grass Frogs<br>• Reduction in habitat quality | • Infrastructure constructed along habitat corridor during construction phase (e.g. storm water)<br>• Stockpiles established in habitat corridor.<br>• Dumping in habitat corridor | 1 | 5 | M | • Road bridge abutments constructed during the pre-construction phase to minimise impact on habitat corridor during the construction phase.<br>• Stormwater infrastructure (e.g. outlets) will be constructed in the habitat corridor post-construction of the habitat corridor. Control measures will be put in place to minimise the impacts of this work, including<br>– Minimising the footprint of the works.<br>– Minimising the clearing of vegetation.<br>– Performing pre-clearance salvage and relocation of Growling Grass Frogs immediately prior to works.<br>• Habitat corridor to be clearly demarcated with “no-go area” signage and exclusion fencing established during the construction phase.<br>• Habitat corridor “no-go zone” covered in all site inductions.<br>• Regular inspections of the habitat corridor to ensure that “no-go” zone is being followed (e.g. no stockpiling in the habitat corridor). | L |

| Incident/event | Potential impact | Cause | Consequence | Likelihood | Risk Ranking | Controls | Residual Risk |
|---|---|---|---|---|---|---|---|
| • Artificial lighting increases in the area as a result of the development. | • Increased artificial light at night alters Growling Grass Frog behaviour and physiology, impacting the local population. | • Artificial light at night known to alter calling (and therefore potentially mating) in other frog species.<br>• Artificial light at night also shown to alter physiology and increase stress in other frogs. | 1 | 4 | L | • Construction limited to daylight hours, so no artificial light will be required during the construction phase.<br>• Keep lights as far from the creek as practical.<br>• Space lights as far apart as practical to minimise unnecessary artificial lighting.<br>• Do not direct light towards the creeks and reduce lateral light spill by:<br>– Installing shields on lights.<br>– Using embedded lights.<br>• Use motion sensor activated lights along pathways.<br>• Avoid high intensity white or blue lighting (<50nm wavelengths). | L |
| • Noise pollution increases as a result of development | • Reduced breeding success of local Growling Grass Frog population. | • Noise from construction, increased traffic and other sources reduces likelihood of calls attracting mates. | 1 | 3 | L | • Construction restricted to daylight hours, so noise impacts on Growling Grass Frog likely to be negligible<br>• Construction vehicles will be fitted with noise reduction equipment to comply with relevant guidelines and approvals.<br>• Only new local roads will be constructed as a result of the New Epping development, so long term noise increase unlikely to be a major issue. | L |
| • Construction removes local Golden Sun Moth population. | • Loss of local Golden Sun Moth population impacts regional population. | • Removal of Golden Sun Moth Habitat. | 1 | 5 | L | • The approximately 5.5 ha of Golden Sun Moth habitat located on site will be cleared as part of the development which will lead to the loss of the local population. However, this will be offset in the Western Grassland Reserve.<br>• As the habitat present on site is small and isolated, the loss of this habitat is unlikely to have an impact on the regional Golden Sun Moth population. | L |
| • Increased erosion during construction | • Reduced Growling Grass Frog habitat quality | • Increased sedimentation reduces water quality in Growling Grass Frog wetlands. | 2 | 4 | M | • Install sediment control barriers along habitat corridor.<br>• Use best practice techniques to minimise erosion.<br>• Install sediment traps where appropriate to reduce sedimentation.<br>• Install sediment traps in storm water drain outlets to reduce sediment input. | L |
| • Chemical/petroleum spill | • Reduced Growling Grass Frog habitat quality and potentially increased mortality | • Inadequate bunding, training, maintenance of equipment or spill kits. | 3 | 3 | M | • Chemicals and hydrocarbons to be stored in lined, bunded areas, with the bund able to contain 120% of the volume of the largest chemical container.<br>• Equipment inspected daily and undergo regular service.<br>• Personnel adequately trained in equipment usage.<br>• Spill kits maintained on site in areas where chemicals are stored and in areas where construction is occurring. | L |

# 9 Environmental management roles and responsibilities

The planned development will be managed by Riverlee, which will be responsible for the implementation of this EMP. The following responsibilities are allocated during the proposed development.

## 9.1 Riverlee

It is the responsibility of approval holder (i.e. Riverlee) to ensure that:

- The requirements outlined in this EMP are implemented.
- All environmental incidents are reported to Riverlee management and, if required, to the DELWP, DoEE, EPA, Melbourne Water and/or the City of Whittlesea.
- There is ongoing communication between Riverlee and relevant stakeholders to keep them informed of any relevant issues and developments, and stakeholders can raise concerns with Riverlee.

## 9.2 Contractor

It is the responsibility of the Contractor to ensure that:

- Together with Riverlee, all aspects off this EMP are implemented.
- All personnel and contractors receive a site specific induction (outlined in section 12) conducted by the site manager or an authorised representative prior to performing any works on site.
- Visitors who do not have to conduct work on site will receive a visitors induction.
- All employees and visitors comply with HSE policies and safe work systems.
- All employees are adequately trained to fulfil their role properly with minimal environmental impact.
- Relevant environmental legislation is complied with.
- All incidents, hazards and near misses are promptly reported, investigated and appropriate corrective actions implemented.
- Identify potential hazards through regular site inspections and implementing corrective action where appropriate.
- Provide ongoing training for employees and contractors to ensure that they have appropriate skill and knowledge to carry out assigned tasks in a safe manner with the lowest environmental impact.

## 9.3 On Site Employees and Contractors

It is the responsibility of all employees and contractors to ensure that:

- All procedures outlined in this EMP are followed to the letter and in spirit.
- Best practice procedures are followed.
- All incidents, hazards and near misses are reported promptly, no matter how minor.

- They take all responsibility to ensure that their safety, the safety of others and the environment are never compromised.
- They report to work in a fit condition, i.e. not influenced by alcohol, drugs, fatigue or any condition that may affect the employee's ability to complete any assigned task in a safe and effective manner.
- Work is not undertaken for which the employee feels they have not received adequate information and/or instruction.
- Actively participate in HSE and training initiatives.

# 10 Monitoring.

A monitoring schedule is provided in Table 14 and explained below.

### 10.1.1 Fence condition

Surveys of exclusion fencing and frog fencing should be conducted monthly during the construction phase. Surveys of the exclusion, vehicle and frog fencing following construction should be conducted quarterly. Any damage to the fence lines must be promptly repaired

### 10.1.2 No-go zones

Over fence inspections of no-go zones should be conducted monthly to ensure that no-go zones are being adhered to (e.g. not being entered, no rubbish dumped). If no go zones are not being enforced, additional signage should be erected and site inductions improved.

### 10.1.3 Growling Grass Frog population

Monitoring for Growling Grass Frog will be essential to determine whether the onsite offset is providing suitable habitat and protecting and offsetting impacts to this species. Monitoring of the onsite Growling Grass Frog population will begin during the first breeding season after construction of the habitat corridor commences, and continue for annually for the duration of the 10 year management period. Monitoring will record the number of individuals and if possible their sex and age (metamorph, sub adult, adult). Monitoring will occur twice over each active season, ideally once early in the breeding season (November-December) and then again later in the active season (January-February) to determine breeding success. As the population dynamics of Growling Grass Frog in the offset is unknown, monitoring is required for both adults and signs of breeding.

Baseline surveys have been conducted in 2014-15 (Wildlife Profiles 2015) 2016-17 (Ecology Australia 2017a) and 2018-19 (Ecology Australia 2019a). As these surveys were conducted in dry and wet years respectively, abundances of Growling Grass Frog varied considerably (27 individuals in 2014-15, 84 individuals in 2016-17 and 91 individual in 2018-19).

Surveys will be conducted in accordance with survey guidelines for Growling Grass Frog (DEWHA 2009b). Specifically, monitoring will be conducted on warm (>12°C), calm nights and should:

- Include a combination of call playback and night visual surveys
- Cover a range of water body types.
- Be accompanied by a habitat assessment, and
- Be undertaken by appropriately experienced personnel.

Surveys will involve walking the whole perimeter of each wetland, including the in channel wetlands in Edgars Creek, unless some of the perimeter of the wetlands are inaccessible. Three 50m transects will also be surveyed along Edgars Creek.

Any incidental observations of Growling Grass Frog will also be recorded.

### 10.1.4 Growling Grass Frog habitat assessment

During Growling Grass Frog surveys, habitat quality will also be assessed to identify any major changes to the habitat on site. This will involve assessing:

- The cover of fringing, emergent and floating vegetation.
- Water quality (electrical conductivity, pH, turbidity, dissolved oxygen)
- Average depth of each wetland and how full each wetland is.
- Sedimentation of the ponds
- Terrestrial habitat management (maintaining tussocks with open spaces in between)

### 10.1.5 Weeds

Weed monitoring will be conducted quarterly for the first two years, after which the rate of monitoring will be reviewed, with monitoring conducted annually at a minimum. Monitoring will continue for the duration of the 10 year management period. Monitoring will consist of inspecting the entire habitat corridor for woody weeds and targeted weeds (Table 8) on foot. Inspecting the entire site would take roughly 5 hours to detect the majority of targeted and woody weeds on site. Infestations of targeted weeds can then be logged using a GPS, and their location given to the weed management contractors for treatment. Infestations earmarked for treatment will be inspected during the subsequent weed monitoring program to evaluate the success of weed management. If major infestations of non-targeted weeds are identified that warrant treatment, the location of these sites should be recorded and passed on to weed contractors. If new weeds arrive on site that need to be controlled, they should be added to the targeted weeds list.

### 10.1.6 Revegetation monitoring

Monitoring of revegetation within and surrounding wetlands will be conducted in autumn and spring by appropriately qualified contractors for the first two years, after which the rate of monitoring will be reviewed, with monitoring to be conducted annually at a minimum. Areas with dead or dying plants should be replanted. If revegetation in certain areas consistently fails, species planted might not be appropriate for vegetation zone (e.g. planting fringing vegetation in emergent zone) and a different suite of species should be planted that is appropriate for the vegetation zone.

### 10.1.7 Tree and shrub monitoring

As tree and large (>2m) shrub cover should be kept below 10%, trees and shrub recruitment should be monitored annually during revegetation monitoring. Estimates of woody vegetation cover will be made for the offset site as a whole, and for the individual wetlands. If woody vegetation cover exceeds 10%, controls should be implemented to reduce cover of trees and large shrubs.

### 10.1.8 Pest animal monitoring

#### Aquatic animals

Initially, wetlands will be inspected for predatory fish monthly during wetland depth monitoring. However the rate of inspections will be reviewed after two years following the construction of the habitat corridor. At a minimum, constructed off channel wetlands will be inspected for invasive aquatic

animals twice annually, once in spring prior to the breeding season and again in autumn. Inspections will involve walking the perimeter of all off channel wetlands and visually inspecting them for invasive fish, including Eastern Gambusia, Common Carp and Redfin Perch. If exotic fish are found to inhabit a wetland, the wetland will be drained and refilled as soon as practical. However wetlands cannot be drained during the breeding season, as any Growling Grass Frog tadpoles present would perish.

#### Terrestrial animals

Monitoring of terrestrial pest animals, including rabbits and foxes, will be limited to incidental records made during the other monitoring programs. The location of any fox dens or rabbit warrens encountered will be recorded, and passed onto a pest animal management contractor to be destroyed.

### 10.1.9 Wetland water levels

Water levels in wetlands should be assessed monthly for the first two years following construction of the habitat and then the rate of inspection can be reviewed. Water levels in permanent wetlands will not be allowed to fall below 0.5 m, and will regularly be filled to 1.5 m. Ephemeral wetlands will retain water over the entire breeding season, and then be drawn down over winter. Depth gauges will be installed in each wetland.

### 10.1.10 Water quality

Salinity will be assessed monthly for the first two years in conjunction with depth monitoring. The rate of salinity testing will be reviewed after two years.

Water quality will also be measured at the same time as Growling Grass Frog monitoring. The following water quality parameters will be measured:

- Water temperature
- Salinity (%)
- pH
- Conductivity (µS/cm)
- Turbidity
- Dissolved oxygen

Additional water quality monitoring will be conducted annually in spring and autumn, when concentrations of heavy metals, nutrients, herbicides and other contaminants will be assessed.

**Table 14 Monitoring schedule**

| Monitoring Activity | Parameter Measured | Monitoring guidelines | Where | When |
|---|---|---|---|---|
| Fence condition | Condition of fences | Survey exclusion, vehicle and frog fences to ensure fences are intact, and whether there is evidence of disturbance within fences.<br>Refer to section 10.1.1 for further details. | Habitat corridor and existing wetlands | Monthly during construction, annually following construction. |
| No go zones | Disturbance in no go zones | Survey perimeter of no go zones for disturbance to ensure that no go zones are being enforced.<br>Refer to section 10.1.2 for further details. | Habitat corridor and existing wetlands | Monthly during construction. |
| Growling Grass Frog population monitoring | Number of Growling Grass Frogs observed, and age class | Two nocturnal call playback and spotlighting surveys per breeding season, covering all constructed wetlands, in channel wetlands and retained quarry pit.<br>Refer to section 10.1.3 for further details. | All constructed wetlands, in channel wetlands and retained quarry pit | Twice per active season, preferably once in November-December and again in January-February. |
| Growling Grass Frog habitat monitoring | Vegetation, water quality and depth, sediment and terrestrial habitat | Habitat quality (vegetation cover, water quality, pond depth, sedimentation and terrestrial habitat management) will be assessed while conducting Growling Grass Frog monitoring.<br>Refer to section 10.1.4 for further details. | All constructed wetlands, in channel wetlands and retained quarry pit | Twice annually during Growling Grass Frog population monitoring. |
| Weed monitoring | Target and woody weeds | Surveys conducted throughout the entire habitat corridor to identify targeted and woody weeds on site, and map their location. Locations will then be provided to weed management contractors for control.<br>Refer to section 10.1.5 for further details. | Habitat corridor | Quarterly for two years following construction of the habitat corridor, after which the rate of monitoring will be reviewed, with monitoring conducted annually at a minimum |
| Revegetation monitoring | Persistence of revegetation | Revegetation at wetlands will be surveyed twice annually to identify areas where revegetation has failed, and further works are required.<br>Refer to section 10.1.6 for further details. | Constructed wetlands | Twice annually for two years following construction of the habitat corridor, after which the rate of monitoring will be reviewed, with monitoring conducted annually at a minimum |

| Monitoring Activity | Parameter Measured | Monitoring guidelines | Where | When |
|---|---|---|---|---|
| Tree and shrub monitoring | Cover of woody species > 1 m | Estimate cover of woody plants across habitat corridor to determine if management is required for woody plants<br>Refer to section 10.1.7 for further details. | Habitat Corridor | Annually, during spring weed monitoring program. |
| Pest animal monitoring | Presence of pest animals (introduced fish, foxes, rabbits) | All constructed off-channel wetlands to be inspected for introduced fish twice annually, including once prior to the Growling Grass Frog breeding season.<br>Signs of terrestrial pest animals to be recording during weed surveys.<br>Refer to section 10.1.8 for further details. | Habitat corridor | Aquatic species – monthly for first two years then reviewed.<br>Terrestrial species – incidentally during other monitoring programs . |
| Water levels monitoring | Depth | Water levels should be monitored monthly for the first two years in all constructed wetlands, and filled as required. The monitoring schedule will be reviewed after 2 years.<br>Refer to section 9.1.9 for further information | Constructed wetlands | Monthly for first two years, and then the monitoring schedule will be reviewed. |
| Water quality monitoring | Water quality | Water quality monitored at each constructed wetland.<br>Refer to section 10.1.9 for further details. | Constructed wetlands | Salinity monitored monthly for first two years then reviewed.<br>In-depth water quality - once in spring, and during each Growling Grass Frog monitoring event. |

# 11 Reporting, auditing and EMP review

## 11.1 Routine reporting

Riverlee must submit an annual report to DoEE for each year of the 10 year management period (i.e. ten years from the completion of the habitat corridor). Reports should be submitted two months before the anniversary of the initiation of this EMP to enable compliance to be assessed before the anniversary date. The annual report will provide enough written evidence that the management and monitoring commitments outlined in this document are complied with, and determine progress against these commitments.

The annual report must include:

- The details of management actions undertaken within the reporting period.
- The details of monitoring activities conducted during the reporting period, including Growling Grass Frog population and habitat monitoring.
- Site photographs, including photos of each constructed wetland.
- Details of compliance or non-compliance with schedule of management actions and performance criteria.
- Details of any incidents or new management issues, with recommendations for corrective actions, and whether the EMP should be reviewed.

Reporting schedule is outlined in Table 15.

Once the habitat corridor is successfully established, the migration and adaptive management phase are complete and existing Growling Grass Frog habitat outside the habitat corridor is removed , an onsite offset management plan (OMP)will come into force, which will outline the ongoing management of the habitat corridor.

## 11.2 Auditing

Riverlee is responsible for auditing the implementation and effectiveness of this EMP. Audits will be conducted by an independent ecologist as follows:

- Following construction of the habitat corridor (approximately 12 months after commencement of action) – this is to ensure that initial management actions are satisfactorily completed.
- At the end of the migration phase (approximately 36 months after commencement of action) – this will involve a review of two or three rounds of annual monitoring, the distribution of Growling Grass Frogs in existing and constructed wetlands and an independent assessment of Growling Grass Frog habitat quality in the constructed wetlands.
- Once existing Growling Grass Frog habitat outside the habitat corridor is removed – this will be the final audit of the implementation and effectiveness of this EMP. The onsite offset management plan will come into for following the completion of construction.

If the timeline takes longer than expected, audits will be conducted every 24 months following the initial 12 month audit. The timing of audits is outlined in Table 15.

Additional audits may be triggered as a result of plan review, or following major environmental incidents resulting in significant changes to the site.

## 11.3 EMP Review

This EMP includes the potential for ongoing adaptive management, whereby management actions may be modified or triggered by major events occurring within the offset site (e.g. fire, flood) or by the results of monitoring (e.g. major population decline or reduction in habitat quality). If there is a major environmental event which results in a significant change to the condition or character of the site or a major Growling Grass Frog population decline, Riverlee must ensure that this EMP is reviewed.

The EMP review will be conducted by Riverlee (or a suitably qualified consultant) in consultation with DoEE and Melbourne Water, City of Whittlesea and DELWP as required. Any changes will be incorporated into this EMP and an updated version will be supplied to the DoEE.

Any part of this EMP can be changed as part of the review in order to adequately respond to the trigger or improve management outcomes under changed site conditions.

This could involve changes to

- Details of site management methodologies
- Monitoring methods
- Monitoring, reporting and auditing programs.

**Table 15 Reporting schedule**

| Type of Report | Timing | Trigger |
|---|---|---|
| **Annual management actions report.**<br>Outlines all management actions completed on site for a given monitoring period (Spring to autumn).<br>May be combined with annual monitoring report. | Report to be completed by June 30 so it can be reviewed prior to subsequent monitoring program. | Not applicable |
| **Annual monitoring report**<br>Present the results of offset site monitoring, including Growling Grass Frog population and habitat condition | Report to be completed as soon as possible following autumn monitoring so results can be interpreted and management actions implemented as needed. | At completion of annual monitoring, or as requested by DoEE |
| **Audit report** | When habitat corridor is constructed, following migration phase, every two years thereafter and at the end of construction. | Not applicable |
| **Review of Environmental Management Plan** | As required | Following a major environmental event that changes the character of the site (e.g. major flood or fire) or a significant decline in the Growling Grass Frog population |

# 12 Environmental training

All people involved in the New Epping development will receive relevant environmental training to ensure they understand their responsibilities when implementing this EMP. Most training will be covered during the site induction, which will be specifically tailored to each individual's role. Where additional training is required for personnel to ensure they meet the requirements of this EMP, it can be performed on or off site.

## 12.1 Site Induction

All personnel will receive a site induction which will be tailored specifically to the role of each person on site. The site induction will outline the environment on site and the contents of this EMP. Specifically the site induction will cover:

- The key points of environmental value on site and matters of national and state environmental significance. At the New Epping site, these include:
  - Growling Grass Frog.
  - Golden Sun Moth.
  - Existing wetlands on site.
  - The proposed habitat corridor, including Edgars Creek, constructed wetlands and the retained quarry water body.
- Understanding the requirements of this EMP and each individual's role in meeting those requirements.
- Site environmental controls, including, but not restricted to, the:
  - Staged development of Growling Grass Frog habitat on site.
  - Establishment of 'no-go zones,' firstly in existing Growling Grass Frog habitat, and then subsequently along the habitat corridor.
  - Construction and revegetation of the habitat corridor.
  - The Growling Grass Frog migration period.
  - Hygiene requirements for chytrid control.
  - Frog fencing.
  - Salvage and relocation requirements
- Role specific environmental controls, including for:
  - Habitat corridor construction personnel – such as the correct layout and design of wetlands, the provision of rocky areas along the perimeter of the wetlands,, providing rocks and logs for basking and calling and sheltering under during the inactive period.
  - Revegetation personnel – such as the zoning of vegetation types within the habitat corridor depending on wetland depth and distance from the wetland, and the correct species to be planted in each zone.

  - Clearing personnel – such as requirements for salvage and relocation within three days of clearing in Growling Grass Frog habitat.
  - Construction personnel – such as salvage and relocation prior to clearing existing habitat, avoiding the habitat corridor, minimising shading where possible and minimising impacts where constructing bridges in the habitat corridor.
  - Maintenance personnel – such as correct weed management (mechanical removal, herbicide spraying and wiping), replacing dead revegetation, managing ephemeral wetlands and invasive species management.
- Environmental incident and emergency response procedures, as outlined in section 13. Personnel should be aware of their requirements to report any near misses, hazards and incidents to senior personnel.
- The potential consequences of personnel not meeting their environmental responsibilities, which may include:
  - Their termination.
  - Stopping work on site until environmental incident(s) adequately addressed.
  - The loss of local population of Growling Grass Frog, which may have repercussions for the regional metapopulation.

Records of all training conducted should be maintained and include:

- The person receiving the training.
- The date the training was received.
- The name of the trainer
- And a summary of the training provided.

# 13 Incidents, non-compliance, and emergency contacts and procedures

## 13.1 Incidents and non-compliance

Any incidents and non-compliance must be addressed with corrective action as soon as possible. An incident is defined in the approval conditions as "*any event which has the potential to, or does, impact on protected matter(s)*".

As outlined in approval conditions 16 and 17, the DoEE must be informed of any incidents or non-compliances within two business days, and the approval holder must provide details within 10 days. Specifically:

16. *The approval holder must notify the Department in writing of any: incident; non-compliance with the conditions; or non-compliance with the commitments made in plans. The notification must be given as soon as practicable, and no later than two business days after becoming aware of the incident or non-compliance. The notification must specify:*
    a) *the condition which is or: may be in breach; and*
    b) *a short description of the incident and/or non-compliance.*
17. *The approval holder must provide to the Department the details of any incident or noncompliance with the conditions or commitments made in plans as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:*
    c) *any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future;*
    d) *the potential impacts of the incident or non-compliance; and*
    e) *the method and timing of any remedial action that will be undertaken by the approval holder.*

Corrective action will be dependent on the non-compliance/incident, but may include

- Improving no-go zone fencing and signage.
- Conducting further salvage and relocation.
- Improve revegetation and vegetation management.
- Improving water management and water quality, especially salinity, in constructed wetlands.
- Controlling weeds and pest animals on site.
- Increase or decreasing rate of mowing on site.
- Replacing or repairing fencing along the habitat corridor and improving user management
- Controlling the spread of chytrid on site.
- Increase monitoring of Growling Grass Frog population and/or habitat.

Major incidents or non-compliance may trigger a review of the EMP as outlined in section 11.3

## 13.2 Emergency contacts

The key emergency contacts for the New Epping development are:

- Riverlee – 03 9620 3888
- Emergency Services – 000 – for life threatening emergencies.
- Wildlife Victoria – 03 8400 7300 – for injured wildlife.
- DELWP wildlife emergencies – 136 186 – for injured wildlife.
- Ecology Australia (or another environmental consultancy) – 03 9489 4191 – for, relocation or other environmental services.
- Environmental Protection Agency – 1300 372 842 – for pollution and chemical spills.
- Department of Environment and Energy – to report incidents - 02 6274 1111

## 13.3 Emergency procedures

The principal environmental incidents that may occur during the construction of the New Epping site are fauna injury and/or mortality, accidental clearing of Growling Grass Frog habitat, chemical spills and floods.

Incidents involving fauna injury/mortality should be addressed by:

- Stopping work immediately in the area (especially in Growling Grass Frog habitat).
- Monitoring injured wildlife. However, injured wildlife should only be handled by suitably qualified personnel.
- Call Wildlife Victoria (03 8400 7300) to tend to injured wildlife.
- If the affected wildlife is a Growling Grass Frog, stop work in the area until salvage and relocation work can be completed in the area.
- Complete an incident report, and implement appropriate controls so similar incidents do no occur in future.

If Growling Grass Frog habitat is accidentally damaged or cleared, the following controls should be implemented:

- Stop work in affected area immediately and remove machinery.
- Repair no-go fencing in area where works occurred.
- Ensure that no go areas are discussed again with construction personnel.
- Remediate damaged Growling Grass Frog habitat.
- Check all exclusion fences for damage, and ensure that there is adequate signage.
- Investigate why works were occurring in no-go area
- Complete an incident report, and implement appropriate controls so similar incidents do no occur in future.

Chemical spills should be addressed by:

- Stopping work immediately.

- If possible, stopping the source of the spill (e.g. switching off machinery/pump causing the spill, of blocking hole if possible).
- If the spill is large, call emergency services if appropriate and the EPA (1300 372 842)
- Containing the spill using materials in spill kits, particularly from entering waterways.
- Cleaning up the spill using absorbent materials in on site spill kits.
- Removing contaminated soil for safe disposal or, if appropriate, remediation.
- Complete an incident report, and implement appropriate controls so similar incidents do no occur in future.

Major rainfall events should be addressed by:

- Implementing best practice erosion control during construction across the site as standard.
- Ceasing work prior to event and removing all machinery and equipment from the flood zone.
- Removing debris and silt following flooding
- Remediating damaged planting and landscaping.
- Cleaning up any spills.

Other incidents should be addressed by:

- Stopping work.
- Removing the source of the incident.
- Implementing corrective action to reverse the impacts of the incident.
- Completing and incident report, and implementing appropriate controls so similar incidents cannot occur in the future.

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# 15 Glossary

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|---|---|
| 10 year management period | The 10 years after the completion of the habitat corridor. |
| ARI | ARI (Average Recurrence Interval) is an estimate of the average time between random events based on historical data. For example, a 1 in 10 year flood event means there is a 10% chance of a flood event of that size occurring in a given year. |
| Bioregion | Defined geographical regions of Australia with similar climatic and geophysical characteristics, and which generally contain a suite of distinct ecosystems and species |
| CaLP Act | Victorian *Catchment and Land Protection Act 1994* |
| Conservation status | Categorisation of the threat risk to biological assets (plant and animal species, EVCs or plant communities) at a defined scale (e.g. national, state), as determined by specific criteria |
| ~~DELWP~~ | ~~Victorian Department of Environment, Land, Water and Planning~~ |
| ~~DoEE~~ | ~~Commonwealth Department of Environment and Energy~~ |
| Ecological Vegetation Class (EVC) | A vegetation classification described through a combination of its floristic composition, life form and ecological characteristics, and its association with particular environmental attributes. EVCs may include one or more floristic communities that occur across a biogeographic range, and have similar habitat and ecological processes operating |
| EMP | Environmental Management Plan |
| Endemic | Naturally found only in a defined geographic area |
| EPBC Act | Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* |
| Exotic | Plants, animals, fungi and other organisms that have been introduced (deliberately or accidentally) to Australia or a given area after European settlement |
| Exotic vegetation | Vegetation comprised wholly or substantially of exotic species |
| FFG Act | Victorian *Flora and Fauna Guarantee Act 1988* |
| GIS | Geographic Information System. A digital platform for creating, analysing and viewing maps and other spatially referenced data |
| High threat weeds | Introduced species (including non-indigenous 'natives') which, as invading species have highly deleterious impacts on indigenous vegetation and faunal habitats |
| Indigenous | Plant and animal species found naturally in pre-European Australia |
| Indigenous vegetation | Vegetation native to Australia or native to a specific geographic region |

Refer to update #52

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|---|---|
| Introduced | Deliberately or accidentally brought to Australia or part of Australia, usually by human agency |
| Metapopulation | A population of populations. Generally it is a network of spatially separated populations that interact through migration between populations. |
| Native vegetation | Species occurring naturally in Australia as part of the pre-European flora or fauna |
| Vegetation community | Term for interacting plant populations forming vegetation. A vegetation community in formal classifications may have characteristic plant species, composition and structure |
| VROTS | Victorian Rare or Threatened Species |
| WONS | Weeds of National Significance |